



Evaluating the Effectiveness of the 2000–2001 NASA “Why?” Files Program

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Announcement

In 2002, the NASA “Why?” Files will become the NASA SCIENCE Files™ and will also be known as the NASA SCI Files™.

Available from:

NASA Center for Aerospace Information (CASI)
7121 Standard Drive
Hanover, MD 21076-1320
(301) 621-0390

National Technical Information Service (NTIS)
5285 Port Royal Road
Springfield, VA 22161-2171
(703) 605-6000

Summary

The NASA “Why?” Files is a research- and standards-based, Emmy® award-winning series of 60-minute instructional programs for students in grades 3-5. Programs are designed to introduce students to NASA, to integrate mathematics, science, and technology through the use of Problem-Based Learning (PBL), scientific inquiry, and the scientific method, and to motivate students to become critical thinkers and active problem solvers. Each of the four programs in the 2000-2001 NASA “Why?” files series included an instructional broadcast, a companion educator’s guide, an interactive web site featuring a PBL activity, plus a wealth of instructional resources. In March 2001, a mail (self-reported) survey (booklet) was sent to a randomly selected sample of 1,000 NASA “Why?” Files registrants. Respondents returned 185 of these surveys, (154 usable) by the established cut-off date. Most survey questions employed a 5-point Likert-type response scale. Survey topics included (1) instructional technology and teaching, (2) instructional programming and technology in the classroom, (3) the NASA “Why?” Files program (television, lesson guide, classroom activity, web-based activity, and web site), (4) classroom environment, and (5) demographics. About 76 percent of the respondents were female, 89 percent identified “classroom teacher” as their present professional duty, about 80 percent worked in a public school, and about 52 percent held a master’s degree or master’s equivalency. Regarding the NASA “Why?” Files, respondents reported that (1) they used the four programs in the 2000-2001 NASA “Why?” Files series; (2) the goals and objectives for the series were met ($\bar{x} = 4.56$); (3) the programs were aligned with the national mathematics, science, and technology standards ($\bar{x} = 4.64$); (4) the program content was developmentally appropriate for grade level ($\bar{x} = 4.39$); and (5) the programs in the series enhanced and enriched the teaching of mathematics, science, and technology ($\bar{x} = 4.61$).

Introduction

The NASA Langley Research Center's Office of Education (OEd) has a primary responsibility within the Agency to develop instructional distance learning programs and to integrate instructional technology. Through the NASA Center for Distance Learning, the OEd has developed a suite of five distance learning programs. Collectively, the goals of the five programs, including the four instructional programs, are (1) increasing educational excellence; (2) enhancing and enriching the teaching and learning of mathematics, science, and technology; (3) increasing scientific and technological literacy; and (4) communicating the results of NASA discovery, exploration, innovation, and research. The NASA “Why?” Files airs nationally on Cable Access, ITV (instructional television), and PBS-member stations. Presently, 187,000 educators, who represent 4.1 million students in 50 states, have registered for the NASA “Why?” Files. Information about the NASA “Why?” Files can be found at the following web site: <http://whyfiles.larc.nasa.gov>.

Evaluation is critical to any program’s success. To determine the effectiveness as well as the credibility and validity of the series, we survey NASA “Why?” Files registrants annually. This report contains the quantitative and qualitative results of our attempt to determine the effectiveness of the 2000-2001 NASA “Why?” Files series. Also included in this report are suggestions for improving the NASA “Why?” Files.

Overview of the NASA “Why?” Files

Produced by the Office of Education (OEd) at NASA’s Langley Research Center in Hampton, Virginia, the NASA “Why?” Files is designed to increase scientific literacy, improve the mathematics and science proficiency of students in grades 3-5, and increase the competency of mathematics and science educators. Now beginning its third year of production, the goals of this research and standards-based,

Emmy® award-winning distance learning program include (1) showing students the application of mathematics, science, and technology on the job; (2) presenting mathematics, science, and technology as disciplines that require creativity, critical thinking, and problem-solving skills; (3) demonstrating the integration of workplace mathematics, science, and technology as a collaborative process; (4) raising student awareness about careers that require mathematics, science, and technology; and (5) overcoming stereotyped beliefs by presenting women and minorities performing challenging engineering and science tasks.

The 2000-2001 NASA “Why?” Files series has received numerous awards for program achievement, educational content, and video production. At the 2001 Mid-Atlantic Emmy® Awards, the NASA “Why?” Files won an Emmy® for Best Children’s Series. Other awards for the 2000-2001 NASA “Why?” Files season include a 2001 Apex Grand Award based on excellence in graphics design and editorial content for the NASA “Why?” Files web site and two certificates for creative excellence from the U.S. International Film and Video Festival’s Awards Competition for *The Case of the Unknown Stink* and *The Case of the Barking Dogs*. A complete list of the awards received by the NASA “Why?” Files can be found at <http://whyfiles.larc.nasa.gov/text/awards.html>.

The NASA “Why?” Files is the second oldest program in the K-12 (pre-college) distance learning initiative. In addition to the goals listed in the Overview, the NASA “Why?” Files also seeks to create opportunities for parental and community involvement, attempts to link formal education (e.g., the school) with informal education (e.g., libraries, museums, and science centers), and also to link pre-service and in-service education. The NASA “Why?” Files model is research and standards based, instructional rather than educational, result oriented, learner centered, technology focused, and feedback driven. The NASA “Why?” Files is free to educators; however, educators must register to receive the lesson (teacher) guides. There are four ways to register for the NASA “Why?” Files:

1. e-mail whyfiles@edu.larc.nasa.gov
2. online at [http://edu.larc.nasa.gov/whyfiles/NASA “Why?” Files](http://edu.larc.nasa.gov/whyfiles/NASA%20Why%20Files)
3. telephone 757-864-6100
4. U.S. mail: NASA Langley Research Center
Mail Stop 400 Office of Education
Hampton, VA 23681-2199

The number of teachers registering for and the number of students viewing each program must be specified.

Rights and Responsibilities

NASA “Why?” Files is a U.S. Government program and is not subject to copyright. No fees or licensing agreements are required to use programs in this series. Off-air rights are granted in perpetuity. Educators are granted unlimited rights for duplication, dubbing, broadcasting, cable casting, and web casting into perpetuity, with the understanding that all NASA “Why?” Files materials will be used for educational purposes. Neither the broadcast nor the lesson guide may be used, either in whole or in part, for commercial purposes without the expressed written consent of the NASA “Why?” Files.

Production and Delivery

Programs in the 2000-2001 NASA “Why?” Files series are 60-minute live broadcasts that comply with the specifications found in the National Educational Telecommunications Association (NETA) Common-

Sense Guide to Technical Excellence. Each program is broadcast (delivered) via KU- and C-band satellite transmission. Public Television System (PBS) affiliates, statewide television systems such as T-STAR, district wide television systems, and cable access channels carry the NASA “Why?” Files. The NASA “Why?” Files is also web cast via the NASA Learning Technology Channel. The NASA “Why?” Files web site has the satellite coordinates and broadcast dates and times.

Availability

For a minimal fee, educators can obtain the NASA “Why?” Files videos and print materials from the NASA Central Operation of Resources for Educators (CORE). Videos and print materials are also available from the NASA Educator Resource Center (ERC).

NASA CORE
15181 State Route 58 South
Oberlin, OH 44074-9799
Phone: (440) 775-1400
Fax: (440) 775-1460
E-mail: nasaco@leeca.esu.k12.oh.us
URL: <http://CORE.spacelink.nasa.gov>

The Importance of Evaluation

Formative and summative evaluation is critical to any program’s success. A 2001 CEO Forum School Technology and Reading Report states, “[a]ssessment should become an ongoing part of instruction to inform and enhance teaching and learning and to promote student achievement” (CEO Forum, 2001). The NASA “Why?” Files is a tool for enhancement and enrichment, and the only way to gauge the effectiveness of that tool is to assess how classroom teachers are using it. Evaluation is important for numerous reasons, and it plays an important role in the evolution of distance education (Hawkes, 1996). First, evaluation improves the credibility and validity of a program (Wade, 1999). Second, evaluation can be used to make changes in the program (Ramirez, 1999). Evaluation is particularly important because of the dynamism inherent both in education and technology. According to Dr. Lawrence T. Frase, Executive Director of the Research Division of Cognitive and Instructional Science at the Educational Testing Service, “The major issue for educational technology in the next millennium will be the effectiveness of its adaptation to social, scientific, and political change” (*THE Journal*, 2000). Third and finally, evaluation can help determine the effectiveness of a program (Hazari and Schnorr, 1999). Because of the wide array of information that can be reaped from the evaluation process, NASA’s Center for Distance Learning conducts an ongoing quantitative and qualitative assessment of each of its programs, including the NASA “Why?” Files.

The 2000-2001 season was the first in which the NASA “Why?” Files underwent a rigorous quantitative and qualitative evaluation. National data concerning teacher demographics, classroom environments, and teacher perceptions of instructional technology were infused into the 2000-2001 NASA “Why?” Files evaluation report, thus allowing the data received through the NASA “Why?” Files evaluation process to be compared to other national studies. In future seasons, the Office of Education may expand evaluation to also include classroom observation by skilled observers and gather student feedback from short surveys. In summary, the Office of Education continually strives to improve the evaluation process by creating more diverse and in-depth measurement techniques. As stated by Michael Hawkes (1996, p. 33), “[b]y using an array of evaluation techniques and including everyone involved in the delivery of distance learning (parents, teachers, students) in data collection activities, evaluation tasks will not appear as

ominous as they once did. More importantly, school leaders will be able to assess whether distance education technologies are part of the solution to improved learning and instruction.”

Methodology

We drew a 1,000-registrant sample from the NASA “Why?” Files database and mailed a (self-reported) survey/questionnaire to the sample group in early March 2001. The survey contained 108 questions, 10 of which dealt with demographics (appendix A). Those receiving the survey had two options: (1) they could complete the survey and return it or (2) they could write “not applicable” on the survey and return it. Respondents also had the option to request a free copy of the final assessment report. (All individuals who returned a survey received a complimentary NASA educational CD-ROM.) In all, 154 usable surveys were received by the established cut-off date. Additionally, 31 surveys marked “not applicable” were also received by the established cut-off date. Reasons given for not completing the survey were logged in the database (appendix B). The overall response rate for the 2000-2001 NASA “Why?” Files evaluation project, with only one mailing, was approximately 18.5 percent.

In addition to the quantitative data we collected, we also recorded all qualitative data received during the 2000-2001 NASA “Why?” Files season. These comments came from the evaluation booklet, e-mail correspondence with educators, traditional mailings to educators, and telephone conversations. Comments were divided into two categories: Solicited Qualitative Comments in the 2000-2001 Evaluation Booklet (appendix C) and Unsolicited Qualitative Comments (appendix D). The collected qualitative data were also incorporated into the changes suggested for the 2001-2002 NASA “Why?” Files season.

Demographics

The evaluation booklet contains a variety of demographic questions, the answers to which can be used to establish each respondent’s profile and classroom environment and to determine teacher/student computer use. Demographic findings for the survey respondents follow:

- About 76 percent of the respondents were female.
- About 32 percent of the respondents were from suburban school districts, 34 percent from rural school districts, and 34 percent from urban school districts.
- About 89 percent of the respondents identified “classroom teacher” as their present professional duty.
- About 80 percent of the respondents worked in public schools.
- About 52 percent of the respondents held a master’s degree or master’s equivalency.
- About 83 percent of the respondents identified themselves as Caucasian.
- The mean and median ages of the respondents were 45.01 and 47, respectively.
- The mean and median “years as a professional educator” were 17.19 and 16, respectively.
- About 60 percent of the respondents owned a personal computer.

Presentation of Data

The survey questions covered nine topics. The respondents were asked to react to questions about instructional technology and programming and its use in the classroom and to items specifically related to the NASA “Why?” Files series. Findings for the nine topics are presented in this section. The topic results are reported in terms of mean (average) ratings when the survey items involved a 5-point Likert scale and in percentages when the questions required other responses. Each question was calculated by using the number of responses (n) to that particular question rather than to the total population of respondents.

Topic 1. Instructional Technology and Teaching

Respondents were asked to rate seven statements related to instructional technology and teaching (table 1). The highest mean rating ($\bar{x} = 4.53$) was given to the statement that *instructional technology enables teachers to accommodate different learning styles*. The next highest mean ratings were given to the statements that *technology increases student motivation and enthusiasm for learning* ($\bar{x} = 4.51$), *enables teachers to be more creative* ($\bar{x} = 4.50$), and *enables teachers to teach more effectively* ($\bar{x} = 4.42$). At slightly lower mean ratings, the respondents reported that *instructional technology increases student learning and comprehension* ($\bar{x} = 4.30$) and *student willingness to discuss content and exchange ideas* ($\bar{x} = 4.20$). The lowest mean rating ($\bar{x} = 3.97$) was given to the statement that *instructional technology is effective with virtually all students*.

Table 1. Instructional Technology and Teaching
[1–5 point scale used to measure agreement; 5 indicates “strongly agree”]

Question: Instructional technology...	Mean	Median	Standard deviation	Min.	Max.	Number of responses (n)
Enables teachers to teach more effectively.	4.42	5	0.09	1	5	154
Enables teachers to accommodate different learning styles.	4.53	5	0.81	1	5	152
Enables teachers to be more creative.	4.50	5	0.81	1	5	154
Increases student learning and comprehension.	4.30	4	0.80	1	5	154
Increases student willingness to discuss content/exchange ideas.	4.20	4	0.86	1	5	151
Increases student motivation and enthusiasm for learning.	4.51	5	0.65	1	5	154
Is effective with virtually all types of students.	3.97	4	1.06	1	5	151

-Min. is minimum; Max. is maximum.

Topic 2. Instructional Programming and Technology in the Classroom

Instructional Programming

Respondents were asked to respond to four statements about instructional technology programming intended for use in the classroom (table 2). Higher mean ratings were given to the statements that *schools have increasingly greater access to instructional technology programs* ($\bar{x} = 4.01$) and that *the majority of these programs are of good quality* ($\bar{x} = 3.68$). Lower mean ratings were assigned to the statements that

the majority of the programs are *not* easily broken into “teachable” units ($\bar{x} = 2.74$) and that the majority of the programs are *not* appropriate (e.g., too advanced or too basic) for their students ($\bar{x} = 2.64$). These means are consistent with the other data reaped through this evaluation, as both of these questions were posed in the negative as a check on respondents’ attention and comprehension of each individual question. These results are consistent with one of the conclusions of the 2001 CEO Forum Report on school technology, which stated that for instructional technology to be positively received “[s]tate, district, and local policies, education programs, and resource allotment must be aligned in order to attain goals” (CEO Forum, 2001). Teachers are looking for more than the mere existence of instructional programming; they are looking for programming that is easily accessible and aligned with educational goals.

Table 2. Instructional Programming
[1–5 point scale used to measure agreement; 5 indicates “strongly agree”]

Question: Indicate the extent to which you agree/disagree with the following statements.	Mean	Median	Standard deviation	Min.	Max.	Number of responses (n)
Increasingly, schools have greater access to instructional programs.	4.01	4	1.02	1	5	152
The majority of these programs are of good quality.	3.68	4	0.99	1	5	149
The majority of these programs are not appropriate (i.e., too advanced or too basic) for my students.	2.64	3	0.09	1	5	148
The majority of these programs are not easily broken into “teachable” units.	2.74	3	1.19	1	5	147

-Min. is minimum; Max. is maximum.

Instructional Technology

Respondents completing the survey reacted to three statements concerning the actual use of instructional technology in the classroom (table 3). Respondents gave the highest mean rating ($\bar{x} = 3.96$) to statement (1) that *administrators support and encourage teachers to use instructional technology in the classroom* and (2) that *classrooms are growing increasingly rich in instructional technology* ($\bar{x} = 3.72$). The lowest rating was given to the statement that *teachers are generally positive about introducing/using instructional technology in the classroom* ($\bar{x} = 3.47$).

Table 3. Instructional Technology
[1–5 point scale used to measure agreement; 5 indicates “strongly agree”]

Question: Indicate the extent to which you agree/disagree with the following statements.	Mean	Median	Standard deviation	Min.	Max.	Number of responses (n)
Administrators support and encourage teachers to use instructional technology in the classroom.	3.96	4	1.21	1	5	142
Classrooms are growing increasingly rich in instructional technology.	3.72	4	0.99	1	5	149
Teachers are generally positive about introducing/using instructional technology in the classroom.	3.47	3	1.07	1	5	146

-Min. is minimum; Max. is maximum.

Respondents were also given a list of seven factors that could prohibit or limit the integration of technology into their instructional programs. They were asked to indicate which of these factors they considered barriers to integrating technology into their instruction (fig. 1). Respondents were not limited to selecting one factor; they could select all factors that applied. Respondents indicated that access to computers was the greatest barrier (75 percent), followed by lack of time in the schedule for technology projects (67 percent), not enough computer software (56 percent), lack of teacher training (47 percent), lack of technical support (47 percent), and lack of knowledge about how to integrate technology into the curriculum (35 percent). The failure of purchased software to be installed was reported as the factor least affecting the integration of technology in the classroom (15.5 percent).

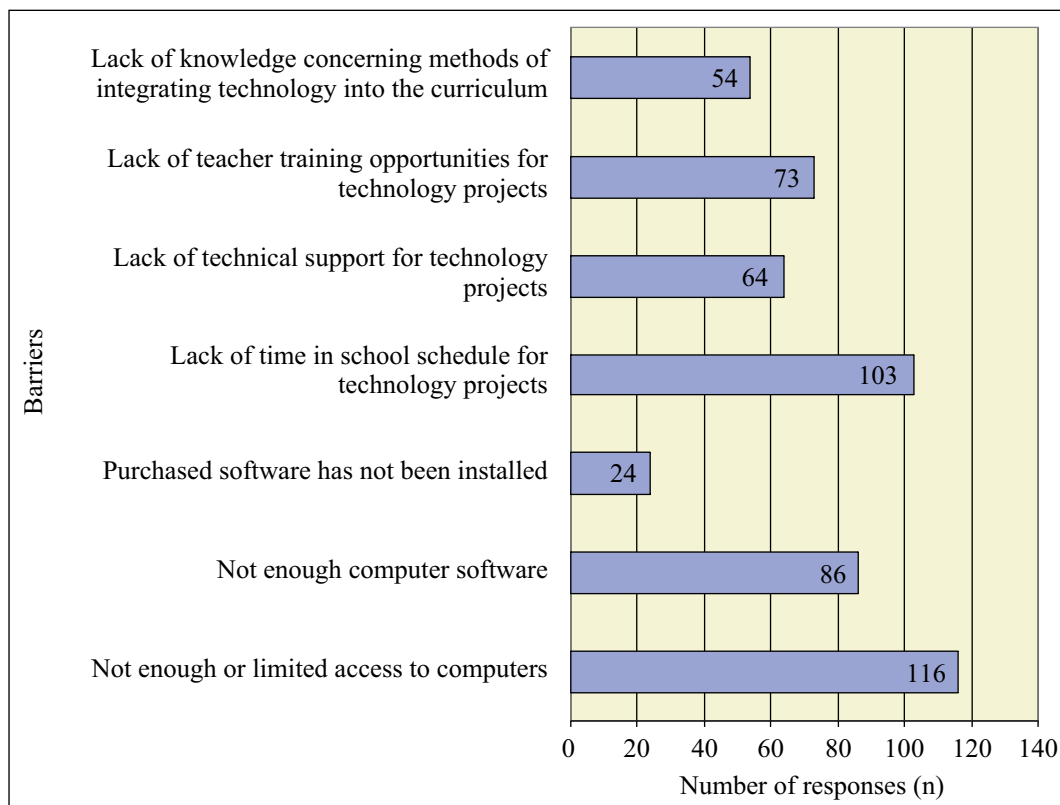


Figure 1. Barriers to integrating technology into the instructional program.

Topic 3. Overall Assessment of NASA “Why?” Files

Respondents were asked to assess the four programs in the 2000-2001 “Why?” Files series (table 4). The highest mean ratings were in response to the statement that *the content of the NASA “Why?” Files series was aligned with the national mathematics, science, and technology standards* ($\bar{x} = 4.64$) and to the statement that *the NASA “Why?” Files program presented mathematics, science, and technology as a process requiring creativity, critical thinking, and problem-solving skills* ($\bar{x} = 4.63$). High mean ratings were also given in response to the statement that *the program content enhanced the teaching of mathematics, science, and technology* ($\bar{x} = 4.61$). Respondents agreed that the programs *presented women and minorities performing challenging engineering and science tasks* ($\bar{x} = 4.53$). The lowest mean ratings were given to the statement that *program content was easily integrated into the curriculum* ($\bar{x} = 4.40$) and that *program content was developmentally appropriate for the grade level* ($\bar{x} = 4.39$).

Table 4. Overall Assessment of NASA “Why?” Files Program
[1–5 point scale used to measure agreement; 5 indicates “strongly agree”]

Question: Indicate the extent to which you agree/disagree with the following statements:	Mean	Median	Standard deviation	Min.	Max.	Number of responses (n)
The programs met their stated objectives.	4.56	5	0.63	3	5	111
The program content was developmentally appropriate for the grade level.	4.39	5	0.76	2	5	114
The program content was aligned with the national mathematics, science, and technology standards.	4.64	5	0.52	3	5	112
The program content was easily integrated into the curriculum.	4.40	5	0.71	3	5	114
The program content enhanced the teaching of mathematics, science, and technology.	4.61	5	0.54	3	5	113
The programs raised student awareness about careers that require mathematics, science, and technology.	4.59	5	0.58	3	5	108
The programs presented the application of mathematics, science, and technology on the job.	4.55	5	0.64	3	5	110
The programs presented workplace mathematics, science, and technology as a collaborative process.	4.60	5	0.58	3	5	110
The programs presented mathematics, science, and technology as a process requiring creativity, critical thinking, and problem-solving skills.	4.63	5	0.57	3	5	111
The programs presented women and minorities performing challenging engineering and science tasks.	4.53	5	0.57	3	5	104

-Min. is minimum; Max. is maximum.

Topic 4. Use of NASA “Why?” Files Video Programs

Respondents were asked whether they used the four programs at the time they were received (table 5). The percentage of “yes” responses varied from 41 percent for program 2 (*The Case of the Barking Dogs*) to 28 percent for program 1 (*The Case of the Unknown Stink*). The percentage of “no” responses varied from 23 percent for program 1 to 17 percent for program 2. Overall, the percentage of respondents indicating that they “may use the program in the future” ranged from 48 percent for program 1 to 41 percent for program 2.

Table 5. Use of NASA “Why?” Files Television/Video Programs
[1–5 point scale used to measure agreement; 5 indicates “strongly agree”]

Question: Did you use the following programs?	Yes		No		May in future		Total program responses
Program	Percent	(n)	Percent	(n)	Percent	(n)	(n)
1. <i>The Case of the Unknown Stink</i>	28	38	23	31	48	64	133
2. <i>The Case of the Barking Dogs</i>	41	55	17	24	41	56	135
3. <i>The Case of the Electrical Mystery</i>	39	53	21	28	40	55	136
4. <i>The Case of the Challenging Flight</i>	36	49	20	28	44	60	137

-(n) denotes number of responses.

Respondents who used the NASA “Why?” Files programs were asked to identify how they used them in their classes (table 6). Respondents were asked to choose from four possible uses for each of the four programs: (1) to introduce a curriculum topic, objective, or skill; (2) to reinforce a curriculum topic, objective, or skill; (3) as a special interest topic; (4) for some other purpose.

Table 6. How NASA “Why?” Files Programs Are Used in the Classroom
[1–5 point scale used to measure agreement; 5 indicates “strongly agree”]

Program number	1		2		3		4	
The program was used...	Percent	(n)	Percent	(n)	Percent	(n)	Percent	(n)
to introduce a curriculum topic, objective, or skill.	28	21	24	18	26	19	22	16
to reinforce a curriculum topic, objective, or skill.	13	14	34	37	35	38	18	19
as a special interest topic.	19	13	25	17	24	16	31	21

-(n) denotes number of responses.

Program Delivery

Respondents were then asked how they viewed each of the four programs. Options included live, taped, or via both methods (fig. 2).

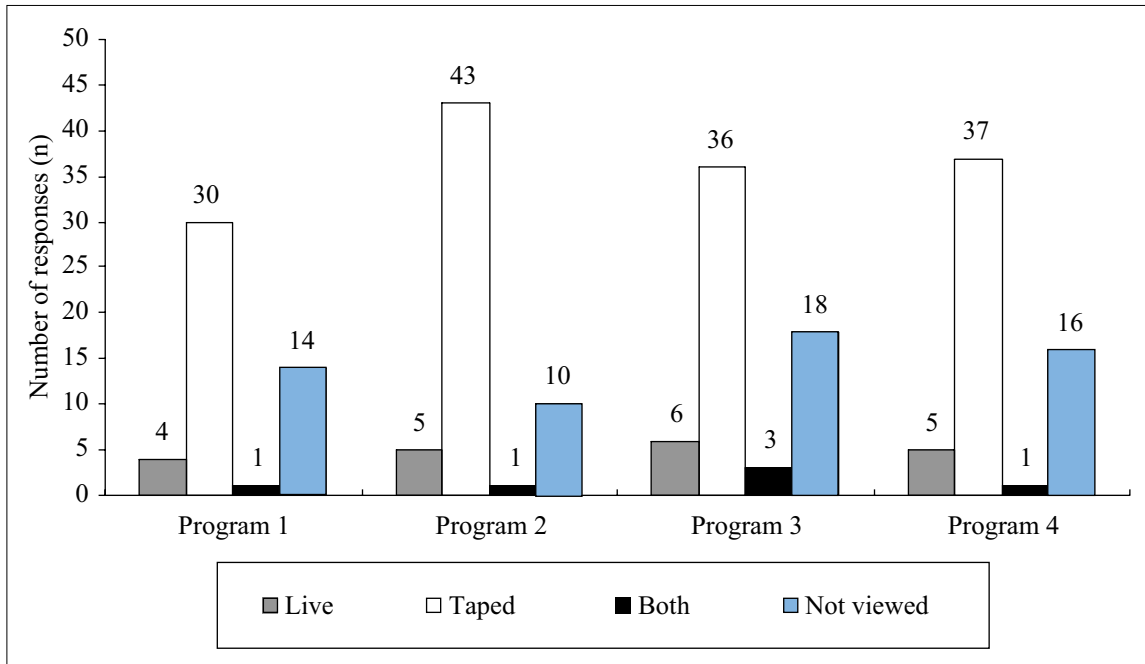


Figure 2. How respondents viewed the NASA “Why?” Files programs.

Program Acquisition

Respondents who used the program were then asked to indicate the method by which they received the program.

- **24 respondents** indicated that the programs were **viewed on PBS**.
- **1 respondent** indicated that he/she had **downloaded** the programs.
- **16 respondents** indicated that a **Media Specialist had taped it** for later viewing.
- **27 respondents** indicated that **they, or someone else, had taped it** for later viewing.
- **33 respondents** indicated that **NASA had sent them** copies of programs.

Ease of Attainability

A follow-up question regarding receipt of the NASA “Why?” Files programs was whether the respondent experienced any difficulty obtaining any of the programs in the 2000-2001 series. Of the 117 respondents to this question, 55 percent indicated experiencing difficulty obtaining the programs.

Grades Viewing the NASA “Why?” Files Programs

Respondents who used the 2000-2001 NASA “Why?” Files were asked to report which grade levels viewed the programs (fig. 3).

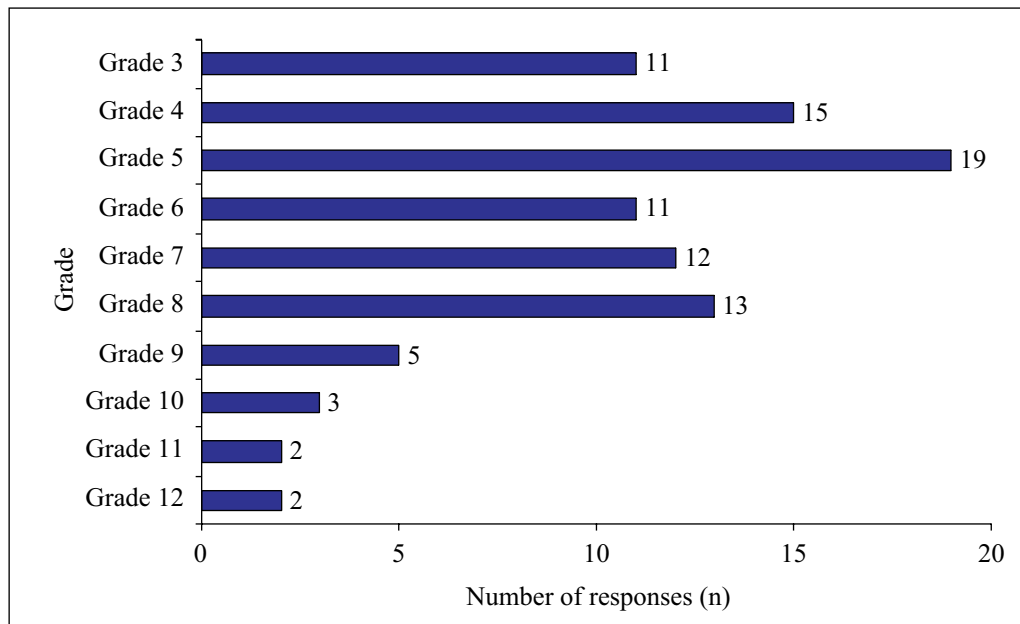


Figure 3. Grade levels viewing NASA “Why?” Files programs.

Quality of Television/Video Programs

The last component of the NASA “Why?” Files television/video program evaluation process asked respondents to evaluate program content and quality by indicating their level of agreement with nineteen statements (table 7). The statements receiving the strongest support from the respondents were *the programs made “learning science” interesting* ($\bar{x} = 4.69$), *the programs were of good technical quality* ($\bar{x} = 4.68$), and *the programs were well organized* ($\bar{x} = 4.65$). High marks were also given to the statements that *the programs demonstrated the application of mathematics, science, and technology on the job* ($\bar{x} = 4.60$), and *the programs presented mathematics, science, and technology as disciplines requiring creativity, critical thinking, and problem-solving skills* ($\bar{x} = 4.55$). The lowest scores were attributed to the statements that *the programs were effective with virtually all types of students* ($\bar{x} = 3.91$), *the programs were developmentally appropriate for the grade level* ($\bar{x} = 4.13$), and *the programs increased student willingness to discuss/exchange ideas* ($\bar{x} = 4.22$).

Table 7. Quality of NASA “Why?” Files Television/Video Programs
[1–5 point scale used to measure agreement; 5 indicates “strongly agree”]

Question: Indicate the extent to which you agree/disagree with the following statements.	Mean	Median	Standard deviation	Min.	Max.	Number of responses (n)
The programs were well organized.	4.65	5	0.58	3	5	100
The programs were of good technical quality.	4.68	5	0.53	3	5	101
The programs made “learning science” interesting.	4.69	5	0.53	3	5	99
The programs increased student knowledge of science.	4.53	5	0.65	3	5	92

Table 7. Concluded

Question: Indicate the extent to which you agree/disagree with the following statements.	Mean	Median	Standard deviation	Min.	Max.	Number of responses (n)
The programs presented a “problem-based learning” environment.	4.45	5	0.70	3	5	101
The programs stressed the importance of information literacy skills.	4.39	4	0.67	3	5	97
The programs increased student willingness to discuss/exchange ideas.	4.22	4	0.75	2	5	90
The programs increased student enthusiasm for learning.	4.35	4	0.71	3	5	91
The programs were effective with virtually all types of students.	3.91	4	1.01	2	5	89
The programs were a valuable instructional aid.	4.44	5	0.70	3	5	95
The programs were developmentally appropriate for the grade level.	4.13	4	0.90	2	5	96
The programs were easily incorporated into the curriculum.	4.26	4	0.79	3	5	97
The programs enhanced the integration of mathematics, science, and technology.	4.65	5	0.58	3	5	100
The programs raised student awareness of careers that require mathematics, science, and technology.	4.68	5	0.53	3	5	101
The programs demonstrated the application of mathematics, science, and technology on the job.	4.69	5	0.53	3	5	99
The programs presented mathematics, science, and technology as disciplines requiring creativity, critical thinking, and problem-solving skills.	4.53	5	0.65	3	5	92
The programs illustrated the integration of workplace mathematics, science, and technology.	4.45	5	0.70	3	5	101
The programs presented women and minorities performing challenging engineering and scientific tasks.	4.39	4	0.67	3	5	97
The programs were a positive link between the classroom activity and the web-based activity.	4.22	4	0.75	2	5	90

-Min. is minimum; Max. is maximum.

Program Length

Each program in the NASA “Why?” Files series is 60 minutes long. Respondents were asked to give their opinion as to the length of the 2000-2001 NASA “Why?” Files programs (fig. 4).

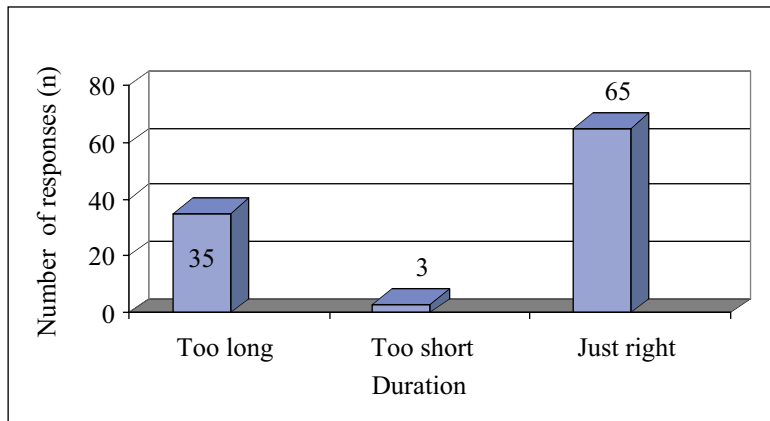


Figure 4. Program length.

Topic 5. NASA “Why?” Files LessonGuides

Use of Lesson Guide

Respondents were asked whether they used the lesson guides they received as part of their registration with the NASA “Why?” Files series (table 8). The percentage of “yes” responses varied from 37 percent for program 1 (*The Case of the Unknown Stink*) to 53 percent for program 3 (*The Case of the Electrical Mystery*). The percentage of “no” responses varied little among the programs, with a mean of 8 percent. Overall, the percentage of respondents indicating that they “may use the program in the future” ranged from 52 percent for program 1 to 38 percent for program 3.

Table 8. Use of Lesson Guides
[1–5 point scale used to measure agreement; 5 indicates “strongly agree”]

Question: Did you use the lesson guides for the following programs?	Yes		No		May in future		Total number of respondents
Program	Percent	(n)	Percent	(n)	Percent	(n)	(N)
1. <i>The Case of the Unknown Stink</i>	37	43	10	12	52	60	115
2. <i>The Case of the Barking Dogs</i>	49	53	9	10	42	45	108
3. <i>The Case of the Electrical Mystery</i>	53	64	9	11	38	45	120
4. <i>The Case of the Challenging Flight</i>	44	53	8	9	48	58	120

-(n) denotes number of responses.

Quality of Lesson Guide

The respondents were asked to react to seven statements about the quality of the NASA “Why?” Files lesson guides (table 9). Respondents indicated that *the lesson guides correlated very well with the videos*, giving it the highest mean rating ($\bar{x} = 4.59$), followed by the statement that *the lesson guides were a valuable instructional aid* ($\bar{x} = 4.57$). High scores were also given to the statement that *the activities and worksheets helped the students learn the “stated” learning objectives* ($\bar{x} = 4.55$), and *the layout of the lesson guides presented information clearly* ($\bar{x} = 4.54$). The statements concerning *the understandability*

of the directions and instructions of the lesson guides, and the value of the print and electronic resources as instructional aids received the lowest mean rating ($\bar{x} = 4.50$).

Table 9. Quality of NASA “Why” Files Lesson Guides
[1–5 point scale used to measure agreement; 5 indicates “strongly agree”]

Question: Indicate the extent to which you agree/disagree with the following statements.	Mean	Median	Standard deviation	Min.	Max.	Number of responses (n)
The lesson guides correlated with the video.	4.59	5	0.67	3	5	78
The activities and worksheets helped students learn the “stated” learning objectives.	4.55	5	0.65	3	5	103
The directions/instructions in the lesson guides were easily understood.	4.50	5	0.75	2	5	106
The layout of the lesson guides presented the information clearly.	4.54	5	0.68	3	5	107
The lesson guides were a valuable instructional aid.	4.57	5	0.66	2	5	106
The print and electronic resources in the lesson guides were a valuable instructional aid.	4.50	5	0.66	3	5	98
The lesson guides were easy to download from the Internet.	4.51	5	0.70	3	5	51

-Min. is minimum; Max. is maximum.

Obtaining Lesson Guides

Respondents were asked whether they had difficulty obtaining any of the guides in the 2000-2001 NASA “Why?” Files series (fig. 5). Only 10 percent of the respondents indicated that they had difficulty obtaining the guides.

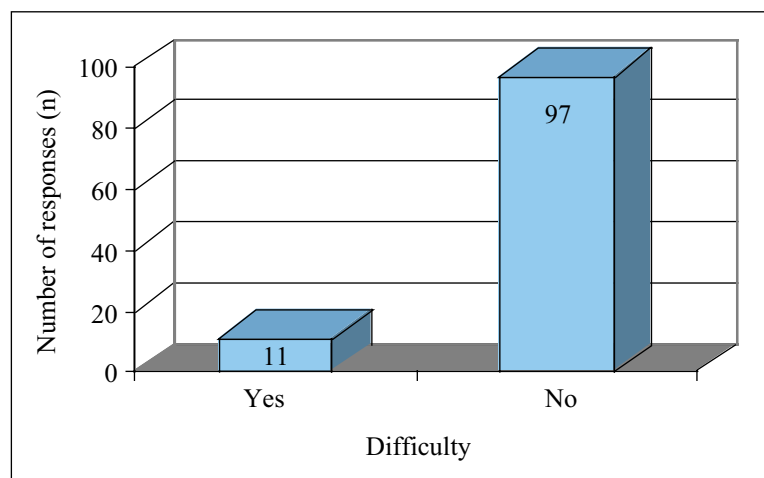


Figure 5. Difficulty obtaining lesson guides.

Topic 6. Problem-Based Learning Activities

Respondents were asked about the Problem-Based Learning (PBL) activities (table 10). PBL is used to introduce students to scientific inquiry and the scientific method. Respondents rated highest the statement that *the content of the PBL activities enhanced the integration of mathematics, science, and technology* ($\bar{x} = 4.38$) and rated lowest the statement that *the content of the PBL activities was easily integrated into the curriculum* ($\bar{x} = 4.22$).

Table 10. Problem-Based Learning Activities
[1–5 point scale used to measure agreement; 5 indicates “strongly agree”]

Question: Indicate the extent to which you agree/disagree with the following statements.	Mean	Median	Standard deviation	Min.	Max.	Number of responses (n)
The content of the PBL activities was easily integrated into the curriculum.	4.22	4	0.73	3	5	58
The content of the PBL activities enhanced the integration of mathematics, science, and technology.	4.38	4	0.67	3	5	60
The PBL activities raised student awareness of careers that require mathematical, scientific, and technological knowledge.	4.34	4	0.66	3	5	59

-Min. is minimum; Max. is maximum.

Grade Levels Using PBL Activities

Respondents who used the 2000-2001 NASA “Why?” Files program were asked to report which grade levels used the problem-based learning activities (fig. 6). The largest percentage of students viewing the 2000-2001 NASA “Why?” Files series were fifth graders (19 percent), followed by fourth graders (14 percent).

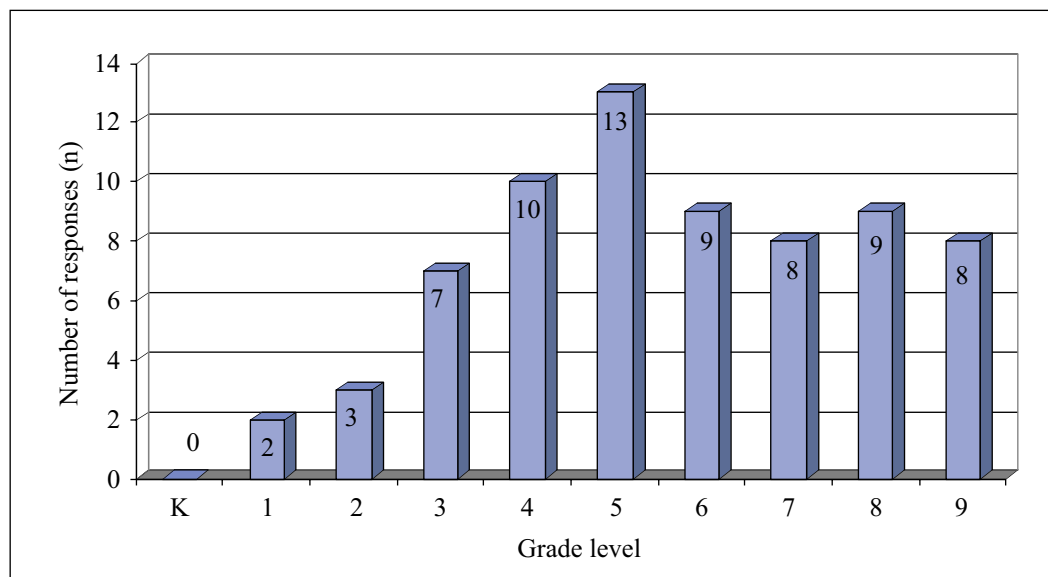


Figure 6. Grade level(s) using PBL activities.

Quality of Problem-Based Learning (PBL) Activities

Respondents were asked to indicate the extent to which they agreed/disagreed with the following statements concerning the quality of the Problem-Based Learning (PBL) activities posted on the NASA “Why?” Files web site (table 11). Respondents gave the highest mean rating to the statements that *the PBL activities had a good balance of text and graphics* and that *the PBL activities will likely be revisited/reused* ($\bar{x} = 4.38$). Respondents gave the lowest mean rating to the statement that *students were able to complete the PBL activities in a reasonable amount of time* ($\bar{x} = 4.04$).

Table 11. Quality of PBL Activities
[1–5 point scale used to measure agreement; 5 indicates “strongly agree”]

Question: Indicate the extent to which you agree/disagree with the following statements.	Mean	Median	Standard deviation	Min.	Max.	Number of responses (n)
Students were able to complete PBL activities in a reasonable amount of time.	4.04	4	0.85	2	5	56
PBL activities accommodated various learning styles.	4.22	4	0.76	3	5	60
Content for PBL activities was appropriate for my students.	4.21	4	0.70	3	5	62
Graphics for PBL activities were appropriate for my students.	4.32	4	0.70	3	5	62
PBL activities enhanced the integration of mathematics, science, and technology.	4.35	4	0.70	3	5	62
PBL activities had a good balance of text and graphics.	4.38	4	0.61	3	5	61
PBL activities allowed my students to work at their own pace.	4.23	4	0.78	3	5	57
PBL activities will likely be revisited/reused.	4.38	5	0.72	3	5	60

-Min. is minimum; Max. is maximum.

Topic 7. NASA “Why?” Files Web Site

Respondents were asked to indicate the extent to which they agreed or disagreed with the following statements concerning the 2000-2001 NASA “Why?” Files web site (table 12). Respondents gave the highest mean rating to the statement that *the NASA “Why?” Files web site is visually appealing* ($\bar{x} = 4.67$). Respondents gave the lowest mean rating in response to the statement that *pages within the web site download quickly* ($\bar{x} = 4.18$).

Table 12. Quality of Web Site
[1–5 point scale used for agreement; 5 indicates “strongly agree”]

Question: Indicate the extent to which you agree/disagree with the following statements.	Mean	Median	Standard deviation	Min.	Max.	Number of responses (n)
The NASA "Why?" Files web site is visually appealing.	4.67	5	0.54	3	5	88

Table 12. Concluded

Question: Indicate the extent to which you agree/disagree with the following statements.	Mean	Median	Standard deviation	Min.	Max.	Number of responses (n)
There is good balance between text and graphics on the web site.	4.56	5	0.61	3	5	84
The web site is easily navigated.	4.49	5	0.68	3	5	87
When viewed on my monitor, the web site is clearly legible.	4.60	5	0.63	3	5	88
The web site is designed so that printouts of individual pages are legible.	4.53	5	0.68	3	5	78
Pages within the web site download quickly.	4.18	4	0.87	2	5	76
The page lengths are appropriate.	4.35	5	0.73	3	5	79
The links to other sites/pages are current.	4.47	5	0.72	3	5	79
The external links provide opportunities for further exploration.	4.51	5	0.62	3	5	78
The web site supports a PBL environment.	4.54	5	0.63	3	5	70
The web site complements the video.	4.53	5	0.70	3	5	68

-Min. is minimum; Max. is maximum.

Topic 8. Classroom Environment

Instructional Technology Equipment

Respondents were asked about the availability and location of specific kinds of technology in their classrooms, schools, and homes (fig. 7). A television, a VCR, a video camera, a laser disc player, video editing equipment, a computer, and a DVD were the items specified. The respondents were asked to mark all that applied.

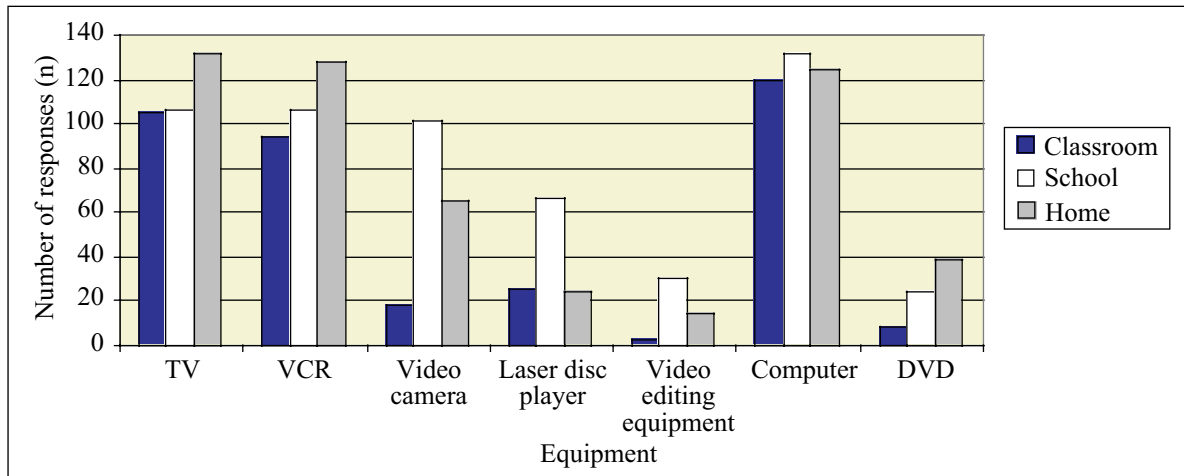


Figure 7. Availability of instructional technology equipment.

Television

- **105 persons** reported they had a television in their **classrooms**.
- **106 persons** reported they had a television in their **schools**.
- **132 persons** reported they had a television in their **homes**.

VCR

- **94 persons** reported they had a VCR in their **classrooms**.
- **106 persons** reported they had a VCR in their **schools**.
- **128 persons** reported they had a VCR in their **homes**.

Video camera

- **18 persons** reported they had a video camera in their **classrooms**.
- **101 persons** reported they had a video camera in their **schools**.
- **65 persons** reported they had a video camera in their **homes**.

Laser disc

- **25 persons** reported they had a laser disc in their **classrooms**.
- **66 persons** reported they had a laser disc in their **schools**.
- **24 persons** reported they had a laser disc in their **homes**.

Video editing equipment

- **3 persons** reported they had video editing equipment in their **classrooms**.
- **30 persons** reported they had video editing equipment in their **schools**.
- **15 persons** reported they had video editing equipment in their **homes**.

Computer

- **120 persons** reported they had a computer in their **classrooms**.
- **131 persons** reported they had a computer in their **schools**.
- **124 persons** reported they had a computer in their **homes**.

DVD

- **8 persons** reported they had a DVD player in their **classrooms**.
- **24 persons** reported they had a DVD player in their **schools**.
- **39 persons** reported they had a DVD player in their **homes**.

Computer Accessories

Respondents were asked about the availability and location of specific computer accessories (fig. 8). The accessories were a CD-ROM, a LAN, a district-wide network, and an internet connection. The respondents were asked to mark all choices that applied.

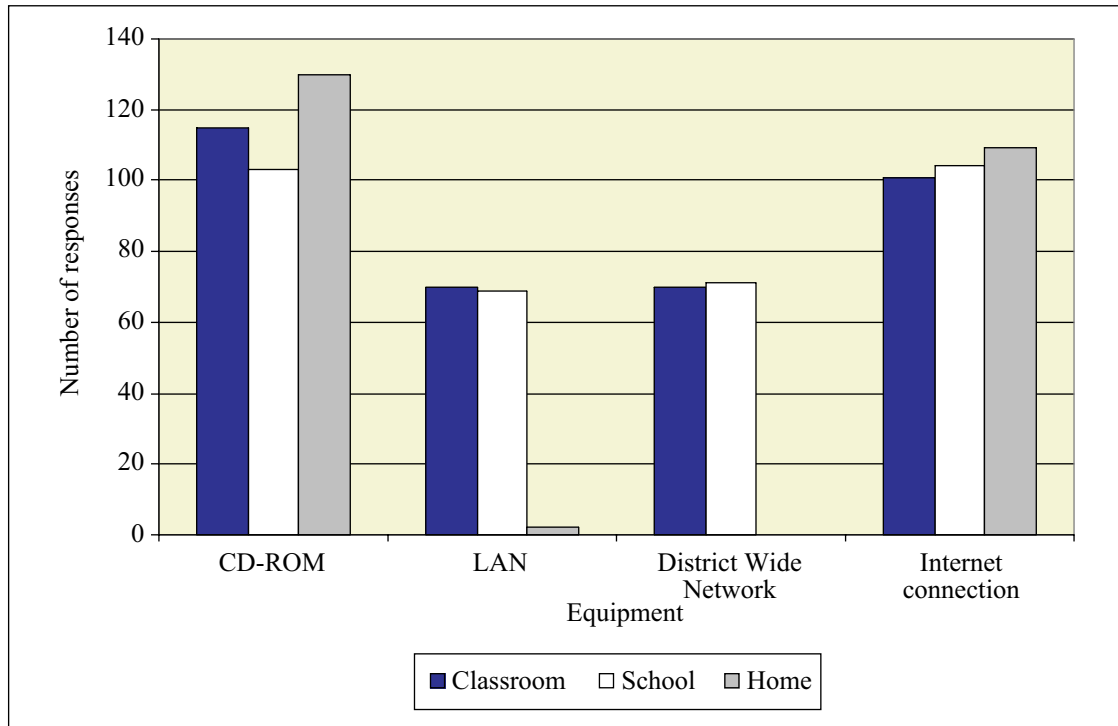


Figure 8. Availability of specific computer accessories.

CD-ROM

- **115 persons** reported they had a CD-ROM in their **classrooms**.
- **103 persons** reported they had a CD-ROM in their **schools**.
- **130 persons** reported they had a CD-ROM in their **homes**.

Local Area Network (LAN)

- **70 persons** reported they had a LAN in their **classrooms**.
- **69 persons** reported they had a LAN in their **schools**.
- **2 persons** reported they had a LAN in their **homes**.

District-Wide Network (DWN)

- **70 persons** reported they had a DWN in their **classroom**.
- **71 persons** reported they had a DWN in their **school**.
- **No one** reported having a DWN in their **home**.

Internet

- **101 respondents** indicated they had internet access in their **classrooms**.
- **104 respondents** indicated they had internet access in their **schools**.
- **109 respondents** indicated they had internet access in their **homes**.

School Computer Operating System

Survey respondents were asked to enter a number for how many computers were in their classrooms. The mean number of computers in each classroom was 3.21. Survey respondents were then asked to identify the type of computer operating system used in their schools (fig. 9).

- **32 reported** that they used **Macintosh** systems.
- **80 reported** that they used **Windows** systems.
- **17 reported** that **both Macintosh and Windows** systems were used.

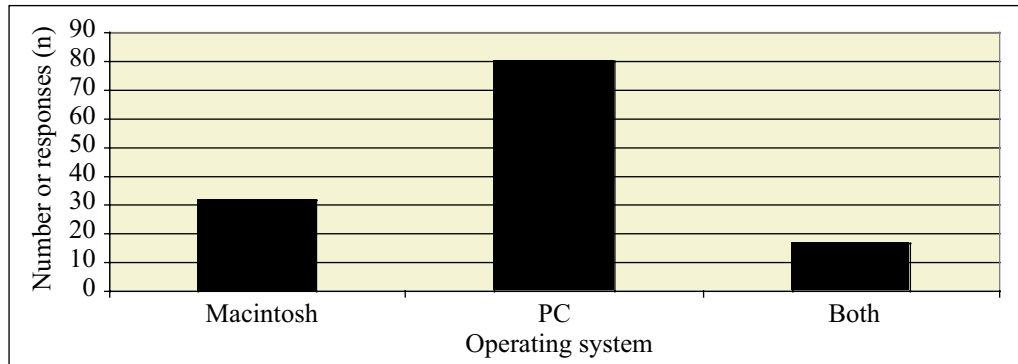


Figure 9. Computer operating systems used in schools.

Student Use of School Computers

Respondents were asked how often a typical student in their schools used a computer during a given month (fig. 10).

- **50 respondents** indicated that students used the computers **1–5 times per month**.
- **26 respondents** indicated that students used the computers **6–10 times per month**.
- **20 respondents** indicated that students used the computers **11–20 times per month**.
- **24 respondents** indicated that students used the computers **21–40 times per month**.
- **11 respondents** indicated that students used the computers **over 40 times per month**.

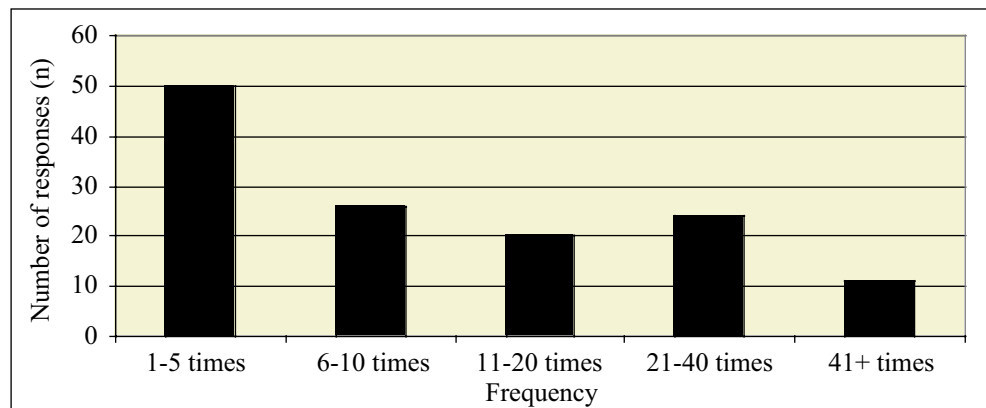


Figure 10. Student use of school computers.

Student-to-Computer Ratio

Survey respondents were asked how the students in their school operated computers in the classroom (fig. 11).

- **68 respondents** reported computer usage at a ratio of **1 student per computer**.
- **41 respondents** reported computer usage at a ratio of **2 students per computer**.
- **10 respondents** reported computer usage at a ratio of **3-5 students per computer**.
- **4 respondents** reported computers were generally used as a class.
- **4 respondents** reported computers were used in other manners.

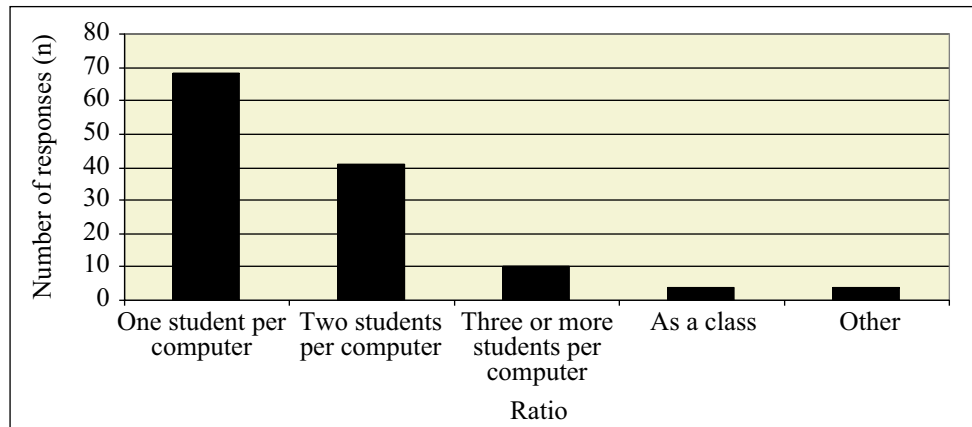


Figure 11. Student-to-computer ratio.

Classroom Connection to Internet

Respondents were asked to indicate how the computers in their classrooms are connected to the Internet (fig. 12).

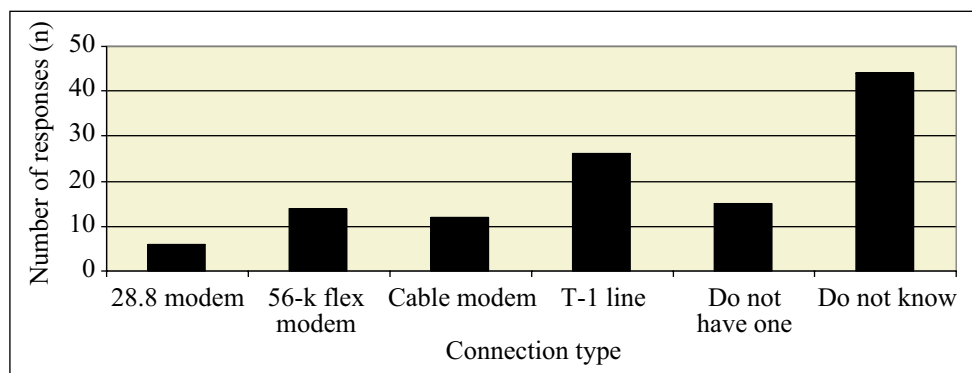


Figure 12. Type of classroom internet connection.

- **6 respondents** reported using a **28.8-K Modem** to connect to the Internet.
- **14 respondents** reported using a **56-K Flex Modem** to connect to the Internet.
- **12 respondents** reported using a **Cable Modem** to connect to the Internet.

- **26 respondents** reported using a **T-1 Line** to connect to the Internet.
- **15 respondents** reported **not having an internet connection**.
- **44 respondents** reported **not knowing what type** of internet connection was in use.

Purposes of Student Computer Use

Survey respondents were given 11 purposes for student computer use and were asked to mark all that applied.

- **97 respondents** indicated computer use for **higher order thinking skills**.
- **82 respondents** indicated computer use for **mastering skills just taught**.
- **83 respondents** indicated computer use for **remediation of skills**.
- **87 respondents** indicated computer use for **expressing ideas in writing**.
- **44 respondents** indicated computer use for **communicating electronically with others**.
- **106 respondents** indicated computer use for **finding out about ideas and information**.
- **65 respondents** indicated computer use for **analyzing information**.
- **53 respondents** indicated computer use for **presenting information to an audience**.
- **90 respondents** indicated computer use for **improving computer skills**.
- **71 respondents** indicated computer use for **learning to work collaboratively**.
- **83 respondents** indicated computer use for **learning to work independently**.

Survey respondents were also given the opportunity to write in comments on their objectives for student computer use. Some examples of these comments are as follows:

- Expanding horizons
- Developing hand-eye coordination and processing information quickly
- Reviewing topics taught

Computer Use for Professional Activities

Educators were asked to identify the ways in which they used computers for lesson preparation or other professional activities and to indicate the frequency of each use (table 13). They were to mark all uses that applied.

Table 13. Computer Use

Question: Educators used their computers to...	Do not use	Occasionally	Weekly	More often
Record/calculate student grades	46	25	20	41
Make handouts for students	3	38	42	50
Correspond to parents	43	54	27	10
Write lesson plans/related notes	23	52	31	29
Get information/pictures from the Internet for lessons	11	64	26	34
Use camcorders, digital cameras, or scanners	68	46	11	9

Table 13. Concluded

Question: Educators used their computers to...	Do not use	Occasionally	Weekly	More often
Exchange files with other teachers	76	46	5	8
Post student work, resource suggestions, or ideas and opinions on the World Wide Web	89	31	7	6

Interpreting the Data

Having presented the survey findings in the previous section, the next step is to interpret them in terms of assessing the quality of the NASA “Why?” Files distance learning program. Excluding the survey demographics, interpretations of the findings are presented for each of the survey topics.

Topic 1. Instructional Technology and Teaching

Based on the data, it is apparent that those surveyed believe that instructional technology increases learning effectiveness and assists in accommodating different learning styles of students. Those surveyed also believe that the use of instructional technology increases student motivation and interest, resulting in increased comprehension and learning abilities.

Topic 2. Instructional Programming and Technology in the Classroom

Recent years have seen a significant increase in the availability and accessibility of instructional technology and programming. Respondents indicated that instructional programming is available and accessible. However, respondents did indicate that the quality of instructional technology programs is low. Despite the dramatic increase in technology in schools, respondents report that computer availability is the greatest barrier to introducing technology in the classroom. Respondents reported that the regimented curriculum is the single largest barrier to using instructional programs in the classroom. Although teachers are encouraged to use instructional programming, the lack of time for computer projects was reported by respondents to be the second greatest barrier to use of instructional technology programming in the classroom.

Topic 3. Overall Assessment of NASA “Why?” Files

The overall assessment of the NASA “Why?” Files series was very positive. The mean responses to questions regarding the overall assessment of the programs in the series were extremely high. Using a 5-point scale, with 5 being the highest value, all values assigned to the questions in this section were 4.3 and higher. Respondents indicated that the content of the programs aligned with national mathematics, science, and technology standards, and that the programs demonstrated the importance of creativity, critical thinking, and problem-solving skills when addressing these disciplines. Respondents also reported that the programs presented workplace mathematics, science, and technology as a collaborative process, and that the programs raised student awareness about careers that require mathematics, science, and technology.

Topic 4. Use of NASA “Why?” Files Video Programs

NASA “Why?” Files is designed to enhance instruction of mathematics, science, and technology in grades 3–5. Respondents reported a fairly even response to using programs to introduce or reinforce a

curriculum topic, objective, or skill or as a special interest topic. Very few respondents indicated that they had viewed the programs live; rather the overwhelming majority had taped them, had someone else tape them, or had received copies from NASA for later use.

Two issues identified from the survey that need to be addressed are (1) acquisition of the programs and (2) use of the programs. About half the respondents indicated difficulty obtaining the programs, perhaps due to technical problems on the part of the respondents or because of technical problems with the satellite broadcast. Over 40 percent of respondents indicated that they were not using the programs but “may in the future.” This significant response may, in part, reflect that some of the teachers were taping the programs until they could integrate them into their preset curriculum schedule. A follow-up assessment would need to be conducted to determine the percentage of respondents who actually do use these tapes at a later date.

When asked for what grade levels the programs were being used, respondents indicated that the programs were being used mostly by fourth and fifth graders, but almost as frequently by sixth through eighth graders (as much or more than third graders). Clearly, the programs in the series are being used in the grade levels that the NASA Center for Distance Learning intends them to be used.

The goals of the NASA “Why?” Files include (1) using problem-based learning to introduce students to scientific inquiry and the scientific method, (2) providing students the opportunity to simultaneously learn subject matter and develop problem-solving skills while engaged in real world problems, and (3) demonstrating workplace mathematics, science, and technology as a collaborative process while raising students’ awareness of careers and overcoming their stereotyped beliefs by presenting women and minorities in challenging careers. These goals are supported by the findings of the Educational Research Service regarding Improving Student Achievement in Science. According to these findings, “Using real-life situations in science instruction through the use of technology (films, videotapes, videodiscs, CD-ROMS) or through actual observation increases student interest in science, problem-solving skills, and achievement” (Cawelti, 1999).

Responses to questions concerning the quality of the NASA “Why?” Files programs were very encouraging. The data suggest that the NASA “Why?” Files is meeting the (previously listed) goals of the series. Respondents indicated that the programs were technically sound, raised student awareness of and demonstrated application of mathematics, science, and technology in the work force, and managed to do so in an interesting manner.

Topic 5. NASA “Why?” Files Lesson Guides

More than half the respondents surveyed said they used the lesson guides. They reported that there was good correlation between the lesson guides and the videos and that the lesson guides were valuable instructional aids, helping students learn the stated objectives. The lesson guide directions and instructions received lower marks regarding ease of understanding; however, the mean rating of 4.5 is still favorable. Very few respondents reported difficulty obtaining the lesson guides. This finding suggests that the current approach to providing lesson guides is appropriate.

Topic 6. Problem-Based Learning (PBL)

“PBL is a method based on the principle of using problems as the starting point for the acquisition of new knowledge. Pivotal to its effectiveness is the use of problems that create learning through both new experience and the reinforcement of existing knowledge” (Lambros, 2002). The NASA “Why?” Files

uses Problem-Based Learning (PBL) to introduce students to scientific inquiry and the scientific method. Each NASA “Why?” Files program allows students to define the problem, perform research and investigations, formulate a hypothesis, perform experiments, collect and analyze data, draw conclusions, and find solutions to the problem. Overall, the NASA “Why?” Files PBL activities received high ratings for both their quality and content. Moreover, respondents indicated that they were likely to revisit/reuse the PBL activities.

Respondents who used the PBL activities indicated that they were beneficial to the integration of mathematics, science, and technology and that they helped increase awareness of careers that require knowledge of these disciplines. The survey indicated that fifth graders used the PBL activities the most, followed by fourth graders, and trailed closely by sixth through ninth graders. The majority of respondents felt that the PBL activities were of high quality and were appropriate for the students who used them.

Topic 7. NASA “Why?” Files Web Site

Survey respondents were not given the opportunity to list whether or how often they used the web site, something that might be incorporated into future evaluation efforts. Responses to questions about the quality of the web site indicated that it was visually appealing and integrated a good balance of text and graphics. Respondents also reported that the web site complemented the NASA “Why?” File videos as well as the PBL environment. The survey indicated that the areas that could use improvement are making web pages quicker to download, adjusting the length of the web pages, and ensuring that the links to other sites and pages are current. Using a 5-point scale (with 5.0 being the highest), respondents were asked to “rate” the quality of the NASA “Why?” Files web site on each of eleven (11) “quality” criteria. The “overall” mean quality rating for the NASA “Why?” Files web site was 4.49. Respondents agreed that the site was visually appealing, easily navigated, and that the links to other sites and pages are current.

Topic 8. Classroom Environment

Instructional Technology Equipment

Respondents were asked several questions regarding the availability of specific instructional technology equipment (e.g., VCRs and DVD players) in their classrooms, schools, and homes. The answers to these questions could “paint a picture” of the existing technology landscape, help explain the “use or non-use” of existing technology-based products, and help us plan the introduction of additional technology-based products as part of the NASA “Why?” Files series. Most respondents indicated the presence of TVs, VCRs, and computers in their classrooms, schools, and homes. The more expensive equipment items (e.g., video editing systems and digital cameras) were found in schools and to a far lesser degree in classrooms and homes. Newer technology (e.g., DVD players) was found in homes and to a lesser degree in schools and classrooms. What these results don’t tell us, however, is what access teachers have to this equipment; how much, if any, training educators have had using it; how many computers educators may have in their classrooms; and the amount of time that is allotted for computer or any other technology equipment use during the school day.

Computer Accessories

Respondents were also asked about the availability of specific computer equipment and accessories in their classrooms, schools, and homes. Again, the answers to these questions could “paint a picture” of the existing technology landscape, help explain the “use or non-use” of existing technology-based products,

and help plan the introduction of additional technology-based products as part of the NASA “Why?” Files series. Perhaps what is most significant is the number of respondents having internet access in their homes, schools, and classrooms. About 70 percent indicated they had internet access in their homes. About 68 percent indicated they had internet access in their schools, while 68 percent indicated they had internet access in their classrooms.

Student Use of Computers

The survey attempted to determine the number of computers in the classrooms and the type of operating system(s) used on these computers. The average number of computers per classroom was slightly more than “3.” Of the respondents, 62 percent reported that their systems were PC operating systems, 25 percent used Macintosh, while 13 percent reportedly used both systems. We also wanted to know how often a typical student used a classroom computer in a month. About 38 percent indicated that students typically use a computer 1 to 5 times a month, 19 percent reported a use rate of 6 to 10 times a month, 15 percent reported a use rate of 11 to 20 times a month, 18 percent reported 21 to 40 times a month, and 8 percent indicated that students used the computers over 40 times per month. Respondents were asked to report the ratio of computers in their classroom to student use. About 54 percent of the respondents reported general computer usage at a ratio of 1 student per computer. About 32 percent reported a ratio of 2 students per computer, 8 percent reported 3 to 5 students per computer, 3 percent reported usage as a class, and the other 3 percent reported “other.” Finally, we wanted to determine the purpose for which teachers had students use the computer. Of the 11 purposes given, the “top three” were “finding out about ideas and information,” followed by “higher order thinking skills,” and “improving computer skills.”

Educators’ Professional Use of Computers

“The training received by teachers and educators is essential to the successful deployment of technology in the classroom” (Thomas, 2000). “Today’s teachers are asked to integrate technology and to incorporate media into their classes to enhance teaching while improving student learning. Money is poured into schools to supply labs with state-of-the-art equipment and software. However, all the best intentions in the world are impossible to accomplish if teachers are not trained sufficiently, are not comfortable with the software and equipment, and/or do not believe in the benefits of current technology” (Ariza, Knee, and Ridge, 2000). Acknowledging this reality, respondents were asked several questions about training and computer use.

Respondents were asked to rate the helpfulness of the school-based technology training provided by their schools or school systems. Most reported that the training was moderately helpful. We did not ask respondents, however, if their school or school division offered school-based technology training. Respondents reported that they most often used a computer for such administrative duties as recording/calculating grades and for such educational purposes as making handouts for students, searching the Internet for lesson use, and preparing lesson plans. Respondents reported that they least often used computers to operate technology-based equipment, to exchange files with other educators, and to post student work assignments on the World Wide Web.

Concluding Remarks

A self-reported mail survey was sent to individuals randomly selected from the database of NASA “Why?” Files registrants. Based on the responses, the following facts have been established for the 2000-2001 NASA “Why?” Files program year. Although there is agreement that schools have greater access to instructional programs and that these instructional programs are of good quality, survey

respondents indicated that most of the programs are either too advanced or too basic and are not easily broken into teachable units. Survey respondents also indicated that while more instructional technology is reaching the classroom, teachers are generally less positive about using it. The greatest barriers to integrating technology into the classroom are (1) not enough or limited access to computers and (2) lack of time in the school schedule for technology (computer-based) projects. The data appear to correlate with information obtained from several large-scale (national) instructional technology studies and indicate that the views held by respondents to this study regarding instructional technology are very similar to those held by their peers.

The NASA “Why?” Files is a research and standards-based annual series of 60-minute instructional programs for students in grades 3–5. Programs are designed to introduce students to NASA; to integrate mathematics, science, and technology through the use of Problem-Based Learning (PBL), scientific inquiry, and the scientific method; and to motivate students to become critical thinkers and active problem solvers. Overall, survey respondents (1) agree that the programs in the 2000-2001 series met their stated objectives; (2) that the length of the programs (60 minutes) was neither too long nor too short; and (3) that the programs are used most often to reinforce topics, objectives, or skills. More than half the respondents indicated that they experienced difficulty obtaining the programs in the 2000-2001 NASA “Why?” Files series. Based on the unsolicited comments, it appears that many survey respondents thought the NASA “Why?” Files series was video based and that NASA would send copies of the videos. Survey respondents reported that the lesson guides correlated well with the instructional broadcast, were a valuable aid, and were easy to download from the Internet. They also gave the Problem-Based Learning (PBL) activities and the NASA “Why?” Files web site high marks.

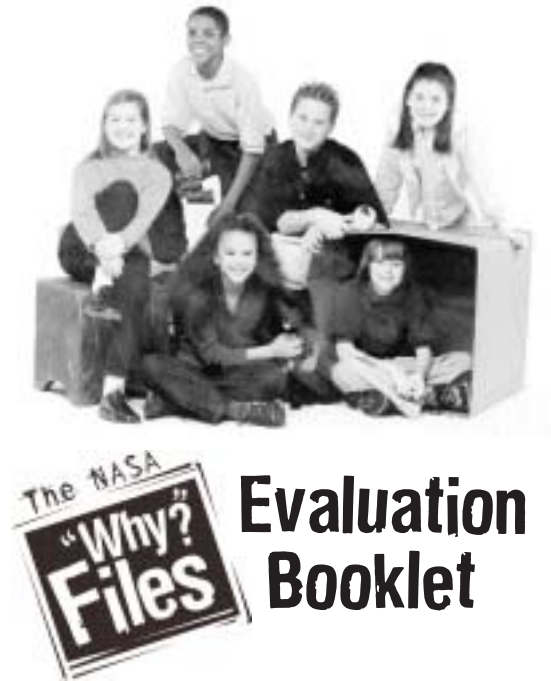
According to the survey results, those who participated in the survey consider the NASA “Why?” Files a beneficial (instructional) resource that enhances and enriches teaching and learning and do use it in the manner that is consistent with a resource. For example, (1) the programs are used in grades 3–5; (2) the instructional broadcast is most often taped for use at a later date rather than being used live; (3) some parts of a NASA “Why?” Files program are used more often than others; and, as an instructional resource, (4) the NASA “Why?” Files is used most often to reinforce topics, objectives, or skills.

Collectively, the data support the continued production of the series. However, during the course of the 2001-2002 season, it would be instructive to evaluate electronically each of the programs in the series. As part of conference attendance and especially as part of any conference presentation, it might be helpful to conduct interviews with educators as a way of (1) learning more about the suitability and usability of the NASA “Why?” Files and (2) identifying barriers that might prohibit or inhibit its use, such as “a fixed curriculum” or “the amount of time available to teach science.” Lastly, it seems that increased use of the programs might result from greater explanation and demonstration of the NASA “Why?” Files. Therefore, participation in pre-service and in-service education workshops and as part of technology exhibits might result in increased use.

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Appendix A



Evaluating the Effectiveness of the 2000–2001 NASA "Why?" Files Program Series

An award-winning, standards-based instructional distance learning program for grades 3-5 that introduces students to science as inquiry, the scientific method, and problem-based learning. The NASA "Why?" Files is produced by the NASA Langley Research Center, Hampton, VA.



Instructional Technology and Teaching

Please indicate (circle the number) the extent to which you disagree or agree with the following statements about instructional technology and classroom teaching.

Instructional technology . . .

1. enables teachers to teach more effectively.

Disagree		Agree		No Opinion
1	2	3	4	5
				9

2. enables teachers to accommodate different learning styles.

Disagree		Agree		No Opinion
1	2	3	4	5
				9

3. enables teachers to be more creative.

Disagree		Agree		No Opinion
1	2	3	4	5
				9

4. increases student learning and comprehension.

Disagree		Agree		No Opinion
1	2	3	4	5
				9

5. increases student willingness to discuss content/exchange ideas.

Disagree		Agree		No Opinion
1	2	3	4	5
				9

6. increases student motivation and enthusiasm for learning.

Disagree		Agree		No Opinion
1	2	3	4	5
				9

7. is effective with virtually all types of students.

Disagree		Agree		No Opinion
1	2	3	4	5
				9



Instructional Programming and Technology in the Classroom

Please indicate the extent to which you disagree or agree with the following statements about instructional programming and technology.

8. Increasingly, schools have greater access to instructional programs.

Disagree			Agree		No Opinion
1	2	3	4	5	9

9. Most of these programs are of good quality.

Disagree			Agree		No Opinion
1	2	3	4	5	9

10. Most of these programs are **not** appropriate (i.e., too advanced or too basic) for my students.

Disagree			Agree		No Opinion
1	2	3	4	5	9

11. Most of these programs are **not** easily broken into "teachable" units.

Disagree			Agree		No Opinion
1	2	3	4	5	9

12. Administrators support and encourage teachers to use instructional technology in the classroom.

Disagree			Agree		No Opinion
1	2	3	4	5	9

13. Classrooms are growing increasingly rich in instructional technology.

Disagree			Agree		No Opinion
1	2	3	4	5	9

14. Teachers are generally positive about introducing/using instructional technology in the classroom.

Disagree			Agree		No Opinion
1	2	3	4	5	9

Instructional Programming and Technology in the Classroom

15. Which of the following factors are barriers to integrating technology into your instructional program? (Check all that apply.)
- ☐ Not enough or limited access to computers
 - ☐ Not enough computer software
 - ☐ Purchased software has not been installed
 - ☐ Lack of time in school schedule for technology projects
 - ☐ Lack of technical support for technology projects
 - ☐ Lack of teacher training opportunities for technology projects
 - ☐ Lack of knowledge concerning methods of integrating technology into the curriculum



Video Programs

The following questions pertain to the four programs in the 2000-2001 NASA "Why?" Files series.

16. Did you use the following programs? (Please check "✓.")

Program	Yes	No	No, but I may in the future
1. ...Stink	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. ...Sound	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. ...Electricity	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. ...Flight	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

17. If you selected "yes," please (✓) indicate how these programs were used.

	Program			
	1	2	3	4
a. To introduce a curriculum topic, objective, or skill	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. To reinforce a curriculum topic, objective, or skill	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. As a special interest topic	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. For some other purpose (please specify)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

18. If you selected "yes" for question 16, please indicate how these programs were viewed. (Please check "✓.")

	Program			
	1	2	3	4
a. Live	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Taped	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Both	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. Not viewed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

19. How did you receive the program? (Please check "✓.")

	Yes	No
1. PBS	<input type="checkbox"/>	<input type="checkbox"/>
2. Downlinked it	<input type="checkbox"/>	<input type="checkbox"/>
3. Media Specialist taped it	<input type="checkbox"/>	<input type="checkbox"/>
4. I or someone else taped it	<input type="checkbox"/>	<input type="checkbox"/>
5. NASA sent me the tapes	<input type="checkbox"/>	<input type="checkbox"/>
6. Other (please specify) _____		

Video Programs, cont.

20. Did you experience difficulty obtaining any of the programs in the 2000-2001 NASA "Why?" Files series? (Please check "✓.")

☐ Yes ☐ No

21. If you selected "yes" for question 16, please indicate the grade level(s) that viewed the programs. (Please circle.)

3 4 5 6 7 8 9 10 11 12

Please indicate the extent to which you disagree or agree with the following statements concerning the four programs in the 2000-2001 NASA "Why?" Files series.

22. The programs were well organized.

Disagree		Agree		No Opinion
1 2 3 4	5		9	

23. The programs were of good technical quality.

Disagree		Agree		No Opinion
1 2 3 4	5		9	

24. The programs made "learning science" interesting.

Disagree		Agree		No Opinion
1 2 3 4	5		9	

25. The programs increased your students' knowledge of science.

Disagree		Agree		No Opinion
1 2 3 4	5		9	

26. The programs presented a "problem-based learning" environment.

Disagree		Agree		No Opinion
1 2 3 4	5		9	

27. The programs stressed the importance of information literacy skills.

Disagree		Agree		No Opinion
1 2 3 4	5		9	

28. The programs increased student willingness to discuss/exchange ideas.

Disagree		Agree		No Opinion
1 2 3 4	5		9	



Video Programs, cont.

29. The programs increased student enthusiasm for learning.
- | | | | | | |
|----------|---|---|---|-------|------------|
| Disagree | | | | Agree | No Opinion |
| 1 | 2 | 3 | 4 | 5 | 9 |
30. The programs were effective with virtually all types of students.
- | | | | | | |
|----------|---|---|---|-------|------------|
| Disagree | | | | Agree | No Opinion |
| 1 | 2 | 3 | 4 | 5 | 9 |
31. The programs were a valuable instructional aid.
- | | | | | | |
|----------|---|---|---|-------|------------|
| Disagree | | | | Agree | No Opinion |
| 1 | 2 | 3 | 4 | 5 | 9 |
32. The programs were developmentally appropriate for the grade level.
- | | | | | | |
|----------|---|---|---|-------|------------|
| Disagree | | | | Agree | No Opinion |
| 1 | 2 | 3 | 4 | 5 | 9 |
33. The programs were easily incorporated into the curriculum.
- | | | | | | |
|----------|---|---|---|-------|------------|
| Disagree | | | | Agree | No Opinion |
| 1 | 2 | 3 | 4 | 5 | 9 |
34. The programs enhanced the integration of mathematics, science, and technology in the classroom.
- | | | | | | |
|----------|---|---|---|-------|------------|
| Disagree | | | | Agree | No Opinion |
| 1 | 2 | 3 | 4 | 5 | 9 |
35. The programs raised student awareness of careers that require mathematics, science, and technology.
- | | | | | | |
|----------|---|---|---|-------|------------|
| Disagree | | | | Agree | No Opinion |
| 1 | 2 | 3 | 4 | 5 | 9 |
36. The programs demonstrated the application of mathematics, science, and technology on the job.
- | | | | | | |
|----------|---|---|---|-------|------------|
| Disagree | | | | Agree | No Opinion |
| 1 | 2 | 3 | 4 | 5 | 9 |
37. The programs presented mathematics, science, and technology as disciplines requiring creativity, critical thinking, and problem-solving skills.
- | | | | | | |
|----------|---|---|---|-------|------------|
| Disagree | | | | Agree | No Opinion |
| 1 | 2 | 3 | 4 | 5 | 9 |

Video Programs, cont.

38. The programs stressed the importance of information technology skills.

Disagree		Agree		No Opinion
1	2	3	4	5
				9

39. The programs presented women and minorities performing challenging engineering and scientific tasks.

Disagree		Agree		No Opinion
1	2	3	4	5
				9

40. The programs were a positive link between the lesson guide and the web site.

Disagree		Agree		No Opinion
1	2	3	4	5
				9

- 40A. The length of the program (60 minutes) is?
(Please check "✓.")

- ☐ too short
- ☐ just right
- ☐ too long



Lesson Guides

Please indicate the extent to which you disagree or agree with the following statements concerning the printed lesson guides used for the four programs in the 2000-2001 NASA "Why?" Files series.

41. Did you use the lesson guides for the following programs? (Please check "✓.")

Program	Yes	No	No, but I may in the future
1. ...Stink	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. ...Sound	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. ...Electricity	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. ...Flight	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Guides not received or not received in time	<input type="checkbox"/>		

42. If no, please explain and then proceed to question #52:

43. The lesson guides correlated with the video.

Disagree				Agree	No Opinion
1	2	3	4	5	9

44. The activities and worksheets helped your students learn the "stated" learning objectives.

Disagree				Agree	No Opinion
1	2	3	4	5	9

45. The directions/instructions in the lesson guides were easily understood.

Disagree				Agree	No Opinion
1	2	3	4	5	9

46. The layout of the lesson guides presented the information clearly.

Disagree				Agree	No Opinion
1	2	3	4	5	9

47. The lesson guides were a valuable instructional aid.

Disagree				Agree	No Opinion
1	2	3	4	5	9

[illegible]



Problem-Based Learning Activity

Please indicate the extent to which you disagree or agree with the following statements concerning the problem-based learning (PBL) activity posted on the NASA "Why?" Files web site.

52. Did you use the PBL activity for the following programs? (Please check "✓.")

Program	Yes	No	No, but I may in the future
1. ...Stink	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. ...Sound	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. ...Electricity	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. ...Flight	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

53. If no, please explain and then proceed to question #67.

54. The content of the PBL activities was easily integrated into the curriculum.

Disagree		Agree	No Opinion
1 2 3 4	5	9	

55. The content of the PBL activities enhanced the integration of mathematics, science, and technology.

Disagree		Agree	No Opinion
1 2 3 4	5	9	

56. The PBL activities raised student awareness of careers that require mathematical, scientific, and technological knowledge.

Disagree		Agree	No Opinion
1 2 3 4	5	9	

57. If you selected "yes" for question 52, please indicate the grade level(s) that used the PBL activity. (Please circle.)

K 1 2 3 4 5 6 7 8 9

58. Students were able to complete the PBL activities in a reasonable amount of time.

Disagree		Agree	No Opinion
1 2 3 4	5	9	

Problem-Based Learning Activity, cont.

59. The PBL activities accommodated various learning styles.
- | | | | | |
|----------|---|-------|---|------------|
| Disagree | | Agree | | No Opinion |
| 1 | 2 | 3 | 4 | 5 |
| | | | | 9 |
60. The content for the PBL activities was appropriate for my students.
- | | | | | |
|----------|---|-------|---|------------|
| Disagree | | Agree | | No Opinion |
| 1 | 2 | 3 | 4 | 5 |
| | | | | 9 |
61. The graphics for the PBL activities were appropriate for my students.
- | | | | | |
|----------|---|-------|---|------------|
| Disagree | | Agree | | No Opinion |
| 1 | 2 | 3 | 4 | 5 |
| | | | | 9 |
62. The PBL activities enhanced the integration of mathematics, science, and technology.
- | | | | | |
|----------|---|-------|---|------------|
| Disagree | | Agree | | No Opinion |
| 1 | 2 | 3 | 4 | 5 |
| | | | | 9 |
63. The PBL activities had a good balance of text and graphics.
- | | | | | |
|----------|---|-------|---|------------|
| Disagree | | Agree | | No Opinion |
| 1 | 2 | 3 | 4 | 5 |
| | | | | 9 |
64. The PBL activities allowed my students to work at their own pace.
- | | | | | |
|----------|---|-------|---|------------|
| Disagree | | Agree | | No Opinion |
| 1 | 2 | 3 | 4 | 5 |
| | | | | 9 |
65. The PBL activities will likely be revisited/reused.
- | | | | | |
|----------|---|-------|---|------------|
| Disagree | | Agree | | No Opinion |
| 1 | 2 | 3 | 4 | 5 |
| | | | | 9 |
66. Please add any other comments you have concerning the PBL activity:



NASA "Why?" Files Web Site

The following questions pertain to the web site for the 2000-2001 NASA "Why?" Files series. Please indicate the extent to which you disagree or agree with the following statements.

67. The NASA "Why?" Files web site is visually appealing.
- | | | | |
|-------------------|--|-------|------------|
| Disagree | | Agree | No Opinion |
| 1 2 3 4 5 | | 9 | |
68. There is a good balance between text and graphics on the web site.
- | | | | |
|-------------------|--|-------|------------|
| Disagree | | Agree | No Opinion |
| 1 2 3 4 5 | | 9 | |
69. The web site is easily navigated.
- | | | | |
|-------------------|--|-------|------------|
| Disagree | | Agree | No Opinion |
| 1 2 3 4 5 | | 9 | |
70. When viewed on my monitor, the web site is clearly legible.
- | | | | |
|-------------------|--|-------|------------|
| Disagree | | Agree | No Opinion |
| 1 2 3 4 5 | | 9 | |
71. The web site is designed so that printouts of individual pages are legible.
- | | | | |
|-------------------|--|-------|------------|
| Disagree | | Agree | No Opinion |
| 1 2 3 4 5 | | 9 | |
72. Pages within the web site download quickly.
- | | | | |
|-------------------|--|-------|------------|
| Disagree | | Agree | No Opinion |
| 1 2 3 4 5 | | 9 | |
73. The page lengths are appropriate.
- | | | | |
|-------------------|--|-------|------------|
| Disagree | | Agree | No Opinion |
| 1 2 3 4 5 | | 9 | |
74. The links to other sites/pages are current.
- | | | | |
|-------------------|--|-------|------------|
| Disagree | | Agree | No Opinion |
| 1 2 3 4 5 | | 9 | |
75. The external links provide opportunities for further exploration.
- | | | | |
|-------------------|--|-------|------------|
| Disagree | | Agree | No Opinion |
| 1 2 3 4 5 | | 9 | |
76. The web site supports a PBL environment.
- | | | | |
|-------------------|--|-------|------------|
| Disagree | | Agree | No Opinion |
| 1 2 3 4 5 | | 9 | |



- | | | | | | |
|----------|---|---|-------|---|------------|
| Disagree | | | Agree | | No Opinion |
| 1 | 2 | 3 | 4 | 5 | 9 |

- [illegible]

Overall Assessment

Please indicate the extent to which you disagree or agree with the following statements concerning the four programs in the 2000-2001 NASA "Why?" Files series.

79. The goals and objectives of the series were met.

Disagree		Agree	No Opinion
1	2 3 4	5	9

80. The program content was developmentally appropriate for the grade level.

Disagree		Agree	No Opinion
1	2 3 4	5	9

81. The program content was aligned with the national mathematics, science, and technology standards.

Disagree		Agree	No Opinion
1	2 3 4	5	9

82. The program content was easily integrated into the curriculum.

Disagree		Agree	No Opinion
1	2 3 4	5	9

83. The program content enhanced the teaching of mathematics, science, and technology.

Disagree		Agree	No Opinion
1	2 3 4	5	9

84. The programs raised student awareness about careers that require mathematics, science, and technology.

Disagree		Agree	No Opinion
1	2 3 4	5	9

85. The programs presented the application of mathematics, science, and technology on the job.

Disagree		Agree	No Opinion
1	2 3 4	5	9

86. The programs presented workplace mathematics, science, and technology as a collaborative process.

Disagree		Agree	No Opinion
1	2 3 4	5	9



Overall Assessment, cont.

87. The programs presented mathematics, science, and technology as a process requiring creativity, critical thinking, and problem-solving skills.

Disagree		Agree		No Opinion
1	2	3	4	5
				9

88. The programs presented women and minorities performing challenging engineering and science tasks.

Disagree		Agree		No Opinion
1	2	3	4	5
				9

Computers and Associated Technology

The following questions pertain to your classroom, your school, and your home.

89. Do you have the following equipment? (Please check all that apply.)

	classroom	school	home
Television	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
VCR	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Video camera	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Laserdisc player	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Video editing equipment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Computer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
DVD	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

90. Does your computer have the following? (Please check all that apply.)

	classroom	school	home
CD-ROM	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Local area network	<input type="checkbox"/>	<input type="checkbox"/>	
District-wide network	<input type="checkbox"/>	<input type="checkbox"/>	
Internet connection	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

91. How many computers are in your classroom? (Please enter a number below.)

____ (if "0", proceed to question #99)

92. The operating system used on your classroom computers is
☐ Macintosh ☐ Windows ☐ Both ☐ Other _____

93. In a given month, about how many times does a typical student use a computer in your classroom? (Please check.)

☐ 1-5 times ☐ 6-10 times ☐ 11-20 times
☐ 21-40 times ☐ 41+ times

94. Generally speaking, how do the students operate the computers in your classroom? (Please check.)

☐ one student per computer
☐ in pairs (2)
☐ in groups of 3 - 5
☐ as a class
☐ other _____



Computers and Associated Technology, cont.

95. My classroom connection to the Internet uses a _____. (Please check.)
- ☐ 28.8 modem
 - ☐ 56-K flex modem
 - ☐ cable mode
 - ☐ T-1 line
 - ☐ do not have one
 - ☐ do not know
96. The school-based technology training provided by my school division improved my computer technology skills.
- | Disagree | | | Agree | | | No Opinion | No school-based training provided |
|----------|---|---|-------|---|--|------------|-----------------------------------|
| 1 | 2 | 3 | 4 | 5 | | 7 | 9 |
97. Which of the following are among the objectives you have for student computer use? (Please check **all** that apply.)
- ☐ Higher order thinking skills
 - ☐ Mastering skills just taught
 - ☐ Remediation of skills
 - ☐ Expressing ideas in writing
 - ☐ Communicating electronically with others
 - ☐ Finding out about ideas and information
 - ☐ Analyzing information
 - ☐ Presenting information to an audience
 - ☐ Improving computer skills
 - ☐ Learning to work collaboratively
 - ☐ Learning to work independently
 - ☐ Other (describe) _____
98. In which of these ways do you use computers to prepare lessons or in other professional activities? (Please check.)
- a. To record or calculate student grades
- ☐ do not use
 - ☐ occasionally
 - ☐ weekly
 - ☐ more often
- b. To make handouts for students
- ☐ do not use
 - ☐ occasionally
 - ☐ weekly
 - ☐ more often
-

**Computers and Associated Technology,
cont.**

- c. To correspond with parents
 - ☐ do not use
 - ☐ occasionally
 - ☐ weekly
 - ☐ more often

- d. To write lesson plans or related notes
 - ☐ do not use
 - ☐ occasionally
 - ☐ weekly
 - ☐ more often

- e. To get information or pictures from the Internet for use in lessons
 - ☐ do not use
 - ☐ occasionally
 - ☐ weekly
 - ☐ more often

- f. To use camcorders, digital cameras, or scanners to prepare for class
 - ☐ do not use
 - ☐ occasionally
 - ☐ weekly
 - ☐ more often

- g. To exchange computer files with other teachers
 - ☐ do not use
 - ☐ occasionally
 - ☐ weekly
 - ☐ more often

- h. To post student work, suggestions for resources, or ideas and opinions on the World Wide Web
 - ☐ do not use
 - ☐ occasionally
 - ☐ weekly
 - ☐ more often



Demographics

These questions will be used to determine whether survey respondents with different backgrounds and characteristics have different opinions regarding instructional technology and NASA "Why?" Files. (Please check the appropriate response.)

99. Gender?

- ☐ Female ☐ Male

100. Present professional duties?

(Please check all that apply.)

- ☐ Teacher
☐ Home Schooler
☐ Technology Program Coordinator
☐ Principal
☐ Math Coordinator
☐ Science Coordinator
☐ Librarian/Media Specialist
☐ Community College Instructor
☐ College/University Instructor
☐ Distance Learning Coordinator
☐ Curriculum Coordinator
☐ Pre-Service Teacher
☐ Pre-Service Educator
☐ Other (please specify) _____

101. School type? (Please check only one.)

- ☐ College/University
☐ Community College
☐ Home School
☐ Native American School
☐ Private/Parochial
☐ Public

102. School location? (Please check only one.)

- ☐ Rural
☐ Suburban
☐ Urban

103. Highest degree?

- ☐ High School Diploma/Equivalency
☐ Associates (2-year)
☐ Baccalaureate (BA/BS)
☐ Master's/Master's Equivalency
☐ Education Specialist
☐ Doctorate

Demographics

104. Ethnicity? (Please check only one.)

- ☐ African American
- ☐ Asian
- ☐ Caucasian
- ☐ Hispanic
- ☐ Native American
- ☐ Pacific Islander
- ☐ Other (please specify) _____

105. How many years have you been a professional educator? (Please enter number below.)

106. Your age? (Please enter number below.)

107. Do you own a personal computer?

- ☐ Yes ☐ No

108. Are you a member of a professional (national) education organization (e.g., NESPA, NMSA, NCTM, NSTA)?

- ☐ Yes ☐ No

Thank you for your assistance

In appreciation for having assisted us, we are pleased to offer you a copy of the 2000-2001 NASA "Why?" Files assessment report. To receive your free copy of the assessment report, please check the box to the right. ☐

With your assistance, the NASA Langley Research Center is providing the educational community with quality instructional distance learning programming for grades 3-5.

Please return to
NASA "Why?" Files
Mail Stop 400
NASA Langley Research Center
Hampton, VA 23681-2199

Appendix B. Comments Returned With Blank Evaluation Booklets

Recipients of the 2000-2001 NASA “Why?” Files evaluation booklet who were unable to adequately assess the program and its components (i.e., they were not able to fit the program into the curriculum) were asked to write “inappropriate” on the front of the booklet. Respondents provided the following additional comments:

Booklet Number	Additional comments
41	Yes; however, materials with minor adjustments could be used at high school levels.
53	Yes; I never received the NASA “Why?” Files for use in my class. I would like to receive the programs next year. At this time, the evaluation is inappropriate.
99	Yes, but thanks and keep up the good work.
121	After registering for the program, I was taken out of my science position.
130	Yes
181	Yes
238	Yes
248	We had technical difficulty so were unable to participate.
267	Yes
275	Yes. Have not had time to review the materials.
316	Yes
329	Yes; I forwarded the “Why?” Files to my daughters’ third grade teacher. I don’t know if she used them....
369	Yes, good material, wrong grade. (I teach grades 6-9; science)
494	Yes
516	Yes
545	I’m sorry but I didn’t have a chance to teach this program.
549	Yes
557	I asked for your materials because my principal wanted me to enquire about your programs for our 3-4-5 grade teachers. I have been teaching writing and language arts all year and have not used your materials. I have received these materials through NASA in Houston before. The teachers were impressed with the graphics.
580	I am sorry I was unable to use the materials. I thought they were too difficult for my fifth graders. Please discontinue me from the program. Thank you.
622	Didn’t get a chance to use program.
683	We did not get to tape the NASA “Why?” Files... They were not broadcast in our area. We will probably order the tapes of the program to utilize another year.
700	Yes
752	Yes; Time restraints prevented implementation of material.
797	Unfortunately, I did not use the NASA “Why?” files this year. They arrived in the fall after my units were written and in progress. In addition, our curriculum changed mid-year, causing time constraints. I hope to review the NASA “Why?” files this summer. Thank you

Appendix C. Solicited Comments to Qualitative Questions

<p>Question 17: Did you use the programs in the 2000-2001 NASA “Why?” Files series? If so, please indicate how they were used.</p> <p><i>If programs were used in a manner not specified (see question 17 in “Assessment Report Charts and Graphs”), respondents were asked to specify how programs were used. The following are comments generated from that question.</i></p>	
Booklet Number	Question 17 comments
792	Yes—Preview for my University students to use
21	Yes—Other teachers in other grades used the programs too.
801	Yes—”Science Fair” at my son’s school
856	Yes—scientific method
330	Never received video; received only printed material
69	I am a high school science teacher.
509	Yes—critical thinking
348	Never received them
244	Have viewed but have not received
115	Moved to kindergarten
203	Yes
528	Did not receive the videos
77	Science investigation
3	Did not receive them
443	I did not use the programs as they do not fit in with my curriculum.
966	I was never sent the videos.
1007	Did not receive video; unable to tape
392	I am not familiar with these programs.
297	No videos available
934	Yes—enrichment program
<p>Question 19: How did you receive the programs?</p> <p><i>If respondents received the programs by means other than those listed (see question 19 in “Assessment Report Charts and Graphs”), they were asked to specify how they acquired the programs.</i></p>	
Booklet number	Question 19 comments
350	No
370	I could not access them (3+4).
348	Never received them
294	NASA sent printed materials.
968	NASA sent paper materials.
211	Did not get the tapes
609	I was under the impression the tapes would be sent to me, as they have been in the past; they weren’t.
999	Had copies made at Huntsville, Alabama while attending space camp with students.
427	I didn’t have the tapes, only the plans.
961	Would like to have the tapes
809	Did not have the tapes—unaware of how to get them—used material
460	Was down linked at local extension office, but I never received the tapes
507	I never got the tapes except for the flight CD.
67	May I have new ones sent to me? I need for next year. Thanks.

72	I never received the tapes (video).
934	Yes—purchased
Question 42: Please indicate which lesson guides were used. If they were not used, please explain. <i>The following are the comments generated from this question.</i>	
Booklet number	Question 42 comments
835	I was never able to use the program. I could not get a copy of the TV program. Due to technical difficulties or human error, I never got a copy of the programs.
110	We were unable to tape <i>Electricity</i> and <i>Flight</i> programs. They were not shown in our area; instead, a more advanced middle/high school NASA program was shown, which the librarian taped for me.
973	I teach 6th, 7th, and 8th grade computers, and we just haven't had enough time to experiment. We did go online, and I just let the students experiment with some of the lessons.
778	The lesson guides for program 1 were not in a format that was as user friendly as programs 2 and 3; 2 and 3 were great. I just haven't gotten the tape for 3.
258	I teach home school. The material I received was for grades 3-5.
742	<i>Stink</i> is not in my grade level curriculum, so I only used the video tape.
792	We used all things at a "preview" level.
370	I could not get program 3.
576	I will use <i>Stink</i> program next year.
186	For programs 1 and 2, I used some lesson aspects of the guide to implement something I wanted to work with.
58	My teaching assignment was changed at the last minute; when I received the guide, I gave copies to the math and science teachers.
231	Not part of 4th grade curriculum
348	I never received the tapes; therefore, we couldn't take part. I'm really sorry.
711	Never received them
169	Need to consider how best to integrate into our system
202	I did not realize I could send for them free of charge.
336	I will be teaching a physical science class this upcoming year (2001-2002). These programs will be useful.
531	They were self explanatory.
592	We already have our curriculum set. I may use them next year.
708	Did not watch the video
968	I used lesson guides with my lesson plans for unit on <i>Flight</i>
211	I could not obtain the video tapes for timely use.
286	Moderately, due to not having the video
355	Teach high school, but some lessons meet needs of weaker students
491	Used school supplied equipment
556	I haven't had time during the school year to explore the programs and see how they'll fit our curriculum.
844	Actually, I used them independently of these tapes
528	Absent most of the year, so did not plan for this unit this year
609	Programs 1 and 4 covered in curriculum—I wrote two grants this year which took up a lot of extra instructional time and kept me from the 1st and 4th subject.
939	Some of it—a little too much work
411	Not a 4th grade Standard of Learning— <i>Electricity</i> was the only one that applied to my grade level's SOLs
816	Did not use the <i>Electricity</i> unit—passed it on to the 4th grade.

177	I will check to see if we received—as far as I know, we did not
68	I used the lesson guides as a source of information for me. I referred to vocabulary definitions and used some of work to copy for some of my classes.
3	I did not receive videos.
741	I never got access to the programs; therefore, I could not use them.
999	Have only received one lesson guide- <i>Flight</i> in the mail
863	Haven't had time to gather all materials
427	Again, I got the guides but didn't have access to videos.
743	These topics were not in my curriculum this year. I plan to incorporate them in the future.
957	I did not have the videos in time. I read through the lessons to be ready to use them next year.
1007	No videos
639	I will use them with the videos. I was unable to obtain all of the videos, which I taped from PBS.
193	I was unable to get the tapes.
961	No time for <i>Stink</i>
983	Did not use this year
407	No guide
362	I had trouble getting someone to tape, and the program was aired during our scheduled lunch time. Our school works on a rigid time schedule.
460	Did not get guides.
568	Programs 1, 3, and 4 not on grade level 2—unit already completed
40	Mismatch in the guide topics and order of course topics. Materials will be used in the future.
60	I didn't have the video, only the guide.

Question 51: Please add any other comments you have concerning the lesson guides.

Booklet number	Question 51 comments
928	Students appreciated the lessons from the guides.
110	<i>Flight</i> did arrive after scheduled showing, but we couldn't tape anyway because of another problem.
938	I received the lesson plans and a CD Rom. There was no video; therefore, I cannot comment on this area of the NASA "Why?" Files; however, the lesson plans were very well thought out.
96	Especially liked <i>Flight</i> since I do a unit on aeronautics and aviation
15	Needs more student activities
778	I was lucky enough to receive the study guides and had to track down the tapes.
604	I would like to have all at the beginning of the year for planning lesson ahead of time.
742	I received the lesson guides in the mail. However, since I did not receive the videotape, I could not do the programs, which were a part of my grade level curriculum. Somehow I was lucky to get program 1 on VHS. I would like the rest of program 1 on tape. Please consider.
21	Keep up the good work. More guides for life science (biology)
856	Guides were great. Could not get videos. I want to use the lessons, but can't. No access to videos.
889	It was a fun way to present topics—different from day to day.
186	I truly enjoyed receiving the guides. I also gave them to other teachers in my school to implement with subject area units of study. I find these a great resource! Thank you. *I especially liked the <i>Flight</i> lesson.
802	<i>Flight</i> guide came to me after the program aired
58	They were excellent; chock full of useful information
185	I'd like the guide to be more oriented to my grade level.

348	I would have loved to share this with my students if I had received the tapes. Please send them to _____
711	Didn't receive materials. The N.Y State Report doesn't have these topics.
169	I loved the lesson guides. They looked great! I look forward to using them.
294	The program is very good. It would be better if CDs and computer ware were available.
336	Wrong address; see sheet
286	The lessons were great, but I found myself focusing less than I should've (or could've) on them due to my not having the tapes. The students enjoyed the challenge of the cases though.
756	Could these programs be made available in VCR format?
744	<i>Stink</i> (program 1) had lesson guide but no handouts that were mentioned in guide to use
816	Some of the activities could be written to help support solving the mysteries instead of being stand-alone. For instance, in <i>The Case of the Barking Dogs</i> , the maps/ graphing activities could relate to the actual data in the video. I found myself making my own maps and matrixes to match with the stories (in the video) so that my students could try to solve the mystery before the tree house detectives.
177	This sounds like a great program. I've announced it, but no one seems to have received these programs.
68	Basically, I used the NASA "Why?" Files for my own information. The vocabulary lists were helpful. The worksheets were useful in some of my classes. I teach 3rd and 4th grade students science. I don't have a room. I go from classroom to classroom with a cart. There are computers in many (most) of the rooms, plus a computer lab. I don't use them at all in my program, and I never downloaded the files from my home computer.
999	Cost of ink prohibits download and printing. I am limited by school budget and will have to request copies from NASA.
443	The lesson guides are excellent. I have used activities from them for my math class and will use some for science.
668	The lesson guides were done very well. My only problem is that they seemed better suited for a younger audience. However, I still used some of the material, and I passed some of the other material along to elem./middle school teachers.
304	My predecessor left and passed very little info to me
639	I am so sorry that I did not use the programs as they came out. I wanted to use them towards the end of this school year, and I still may!
732	Excellent motivation
961	My students and I enjoyed the lessons presented. The integration is fabulous.
983	Could not get links, but the tapes and lessons were sent in a very timely manner
809	Never saw how to get videos or web sites—remember looking and looking but must have missed something
507	The lessons look very well done; unfortunately, I am not able to use them just now. I also passed on some of the NASA "Why?" Files to a budding science teacher. Can you add her to your mailing list?
934	Some lessons were hard to understand—couldn't "connect" the activity sheet with what the lesson guide indicated
<p>Question 53: When asked if the Problem-Based Learning activity was used for its respective program, respondents were instructed to explain if they selected "no." <i>The following comments were generated in response to this prompt.</i></p>	
Booklet number	Question 53 comments
823	I was very limited this year as to what I could use due to a new Server Pro being introduced.
835	I was never able to use the program. I could not get a copy of the TV program. Due to technical difficulties or human error, I never got a copy of the programs.

110	We were unable to tape <i>Electricity</i> and <i>Flight</i> . They were not shown in our area; instead, a more advanced middle/high school NASA program was shown, which the librarian taped for me.
973	Not enough time!
15	Time constraints
778	I would like to obtain the <i>Electricity</i> tape. I would definitely use it.
604	Not enough time planned for in my lessons
89	Not enough time
742	<i>Stink</i> is not in my curriculum
792	All materials were previewed by my university students.
370	Couldn't use without tapes
674	<i>Flight</i> does not really pertain to SOLs
856	I need the whole package and more time to integrate units.
889	I felt enough was in what I received.
330	Not enough time in curriculum this year
333	Between problems with our school district server and not being able to get onto your site at school, we (the kids and I) were very frustrated.
833	I haven't viewed the NASA web site.
186	I am planning to do further integration - for next year - I would like to work on some web quest integration.
503	Did not have time to access web site.
58	My teaching assignment changed to language arts.
231	1 computer in classroom—difficult to obtain projection machine
711	No, not enough time
169	Again, I plan to decide the best way to integrate for 2001-2002.
202	I do not have access to the web site.
592	We already have our curriculum set. I may use them next year.
862	Not enough time
968	Haven't used the NASA "Why?" Files web site all that much—maybe once or twice
142	Did not copy from PBS TV
203	Not enough time this year
211	Did not get a chance to use the program
491	Used school supplied equipment
556	NY State fourth graders spend most of their time preparing for state test—no time for extras
756	Learned about program too late
528	Same as 42
609	Programs 1 and 4 are covered in curriculum. I wrote 2 grants this year, which took up a lot of extra instructional time and kept me from the 1st and 4th subjects.
744	Our school had difficulty getting to the web site (in the computer lab).
411	I only allowed enough time to do resource guide due to tight schedule to get all SOLs
816	Not enough computers for students to complete the activities in a timely manner
741	No access to the videos—No reason to use the PBL
999	Received first guide too late in school year to incorporate into curriculum
880	Did not have the time
427	Couldn't access it at my school
743	Time limitations with completing my science curriculum for 3rd grade
668	Too basic a level
957	Received them (videos) Late
966	Time factor
639	I was not coordinating packets, videos on a timely basis

193	I was unable to get the tapes
738	Ran out of time
961	No time
983	Web links did not work. They were blocked from our server.
362	Did not see airing and need to order tapes
809	Never saw how to get videos or web sites. Remember looking and looking –must have missed something
460	Did not have it
18	Programs 3 and 4 not part of my grade’s curriculum
240	#1 Didn’t use programs
568	1, 3,4 not on grade level 2—Unit already completed
860	Not enough time
40	Mismatch in the guide topics and order of course topics.—Materials will be used in the future
297	Too difficult to do. Board of Ed. blocks
Question 66: Please add any other comments you have concerning the PBL activity.	
Booklet number	Question 66 comments
110	In <i>Electricity</i> , were the labels and diagrams of closed and open switches correct? I thought they should be reversed.
15	Needs to include high order thinking skills and problems related to daily life
695	I am home schooling one gifted child—only wish more activities were available
744	What the students were able to use they enjoyed.
732	Very good activity
961	All materials were great.
407	No guide
460	I would like to use this year since I will have a group of students that are more independent and will be able to do it as an extension of the lesson
934	Not a good program for advanced students—too simple
Question 78: Please add any other comments you have concerning the NASA “Why?” Files web site.	
Booklet number	Question 78 comments
973	I do not have the materials needed to fully answer most of these questions.
15	The web site should be oriented towards progressional learning. An inquiry based approach is needed.
89	Did not get a chance to view the web site. Will/Hope to this summer
742	very good– Nice to have a site to integrate with the program
792	University students were not instructed to go to web site as an assignment. However, several did and found out the site was okay.
801	I have not used the web site
856	All NASA web sites are great!
471	I could not access the NASA “Why?” Files web site.
333	The web site is awesome and I was incredibly frustrated that I was unable to access it from school. Many of my students are technologically savvy and would have enjoyed the site.
511	Unfortunately, due to the new recent commitments in NYS could not use it in full

69	I never was sent any of the videos. I received the problem-solving activities that came in booklet form. I passed them on to a 5th grade teacher. She told me she enjoyed learning and using the books. If you have any materials appropriate for H.S. science, I would love to get a hold of them. Thanks.
58	Great!
605	Haven't been there
348	We've been in a transition year adjusting curriculum and activities to match "NYS" standards for preparation to take the Intermediate Level Science Assessments. It's been a hectic Year... I'm looking forward to integrating your video programs next year (but I still need the videos).
1004	I do have not access to the Internet in my classroom.
169	I find the web site informative and helpful.
202	I am not able to access the web site. Our school does not have the Internet. We did have but principal had it cancelled.
294	Do not have access to computers or software
989	The web site was enjoyed by my students.
142	What is the web site code? Did not use
491	Old computers are a minor problem with downloads
844	NASA sites are traditionally long downloaders on our computers.
609	Did not use because of computer problems-lack of ability to get Internet most of the year
741	I had difficulty getting into the web site each time I tried.
999	All I have been able to access was the <i>Electricity</i> Free house. Are others available? If so, I didn't find them.
427	I would try it if I had all the materials—lessons, videos, access to computers in order to use the web site
668	Didn't use the web site
639	I cannot answer this section, as I have not reviewed the web site.
961	Unable to access due to time constraints, SOLs
809	Never saw how to get videos or web sites. Remember looking and looking—got most but have missed something
460	Have not connected—Will need to review after use
507	I like the Why Files. It is very interesting and helpful. I even try to use some of the information with my grandson.
430	Web only available in library— We will use the web more effectively in our new lab in the fall 2001.
297	Blocked by Board of Ed.
Question 94: Respondents were asked to indicate how students use computers in their classroom. If "other" was selected, the respondents were asked to specify the way their students use classroom computers.	
Booklet number	Question 94 comments (other)
846	Other-Students are assigned computers in labs and media center. Computers in rooms are rarely used by students.
330	All of the above
491	Different combinations at different times.
145	They don't very often—the one computer is mostly for teacher use.
668	Don't use – go to computer room.

Question 97: Respondents were asked to mark their objectives for student computer use on a checklist. If respondents marked “other,” they were asked to specify their “other” objective(s).

Booklet number	Question 97 comments (other)
973	WP, DB, SS, ethics, telecommunications, multimedia
742	Yes, foreign language enrichment
9	Yes
169	Expanding horizons
202	Developing hand and eye coordination and processing information quickly
743	Reviewing topics taught
392	Use of simulation software to later apply knowledge in the real world
732	digital imaging
407	Projects, independent

Question 100: Respondents were asked to select their professional duties from a checklist. If the respondents selected “other,” they were asked to specify their “other” duties. The following responses were generated by this request.

Booklet number	Question 100 comments (other)
330	Building team leaders
186	Yes, teacher, trainer, network admin.
648	Yes, remediation
711	help with computers
169	instructional assistant
211	staff developer
145	parent of a home school student
411	yearbook coordinator–testing coordinator
855	director of education museum
304	Yes
961	Yes, lead teacher

Question 104: Respondents were asked to mark their ethnicity from a list. If they marked “other,” they were asked to specify. The following comments were generated from this inquiry.

Booklet number	Question 104 comments (other concluded)
9	Israeli
711	Armenian
609	Irish, German, French

Appendix D. Unsolicited Comments

Any miscellaneous comments made in the evaluation booklets outside of specified fields were recorded and can be found below.

Booklet number	Miscellaneous Comments
835	The program looked great, and I really wanted to use it. I have saved all the guides and keep hoping our PBS channel will reshow them.
110	Thanks for a well-developed program.
792	I am a university professor working with elementary education students. This is a practicum-based class, housed on an elementary campus in the Corpus Christi ISD. All your materials were previewed by all my students. Thanks.
333	P.9—The video programs were rather immature for my 5th grade students.
348	Please send NASA “Why?” Files Tapes to
244	I have the guides but not the videos. Please send if possible.
247	I would have liked to have used these materials. When I was at KSTA, I stopped by the NASA booth and filled out a form to receive the video; I never received it. I was unable to access the internet addresses. I would still like to receive the video. I’d like to use these materials next year.
286	Is there any way I could still get the tapes that go with the “files?” I’d love to have them.
844	My school does not have the capability to tape them due to lack of feed. I need to arrange copies from NASA.
816	I want my students to be actively involved in the cases NASA presents. It would be powerful and even more authentic if the programs allowed for the students watching to attempt to use the scientific method while the tree house detectives do too. In other words, allow the program to present the case (question), give information from the experts, conduct an experiment or two (and provide one or two for the classroom that supports solving the case instead of just being stand-alone activities) and then give a final answer. I made my students present their “answers” (hypothesis) in a “science forum” before we would watch the conclusions. * Hope to see the programs work to involve the audience with solving the mystery—not just watching the tree house detectives solve it.
177	I answered as much as I could without having the “Why?” Files. It sounds great.
999	Have not used program in class yet.
349	I wish you would make videotapes of all the “Why” Files. I would be willing to pay your shipping cost and a small fee. I found it very hard to find and tape the programs on TV. That is why I have not done programs 3 and 4... I missed the TV times; thus, I don’t have the tapes!!!
443	My answers are based on my review of the printed materials and the web site.
427	The materials-paper were excellent. I didn’t have access to the videos.
392	I am the science teacher at the Capitol School. _____ is no longer with us, so _____ gave me this information to complete. I integrate NASA educational materials in my teaching, so I will enjoy continuing to receive your correspondence. Thank you very much.
983	P. 9—link blocked by our surf-blocker
460	I hope you can still use this. We were involved in state testing, a week-long field trip with the fifth grade, and then the end of school, which was just out last week. Please note: We do not get a star link from satellite in our school, so it is very difficult to get programs unless they are on KET or sent directly P. 7 Have not seen, but NASA is always good Quality
507	Sorry it took so long to return this to you but I was away on vacation. Thanks
268	Sorry I couldn’t be more helpful, but I hadn’t received the materials yet when I covered the topics. Hopefully, I can use them in the coming year. Thanks
67	May I obtain new copies of the videos? I need for next year. Thanks.
72	* Please note never received the “Why?” Files video series P. 7—In reference to paper copies of programs –Except Videos P. 10— Didn’t receive video
297	P. 9—No opportunity to tape—No access to tapes—No money to purchase tapes

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14. ABSTRACT NASA "Why?" Files, a research and standards-based, Emmy-award winning series of 60-minute instructional programs for grades 3-5, introduces students to NASA; integrates mathematics, science, and technology by using Problem-Based Learning (PBL), scientific inquiry, and the scientific method; and motivates students to become critical thinkers and active problem solvers. All four 2000-2001 NASA "Why?" Files programs include an instructional broadcast, a lesson guide, an interactive web site, plus numerous instructional resources. In March 2001, 1,000 randomly selected program registrants participated in a survey. Of these surveys, 185 (154 usable) met the established cut-off date. Respondents reported that (1) they used the four programs in the 2000-2001 NASA "Why?" Files series; (2) series goals and objectives were met; (3) programs met national mathematics, science, and technology standards; (4) program content was developmentally appropriate for grade level; and (5) programs enhanced/enriched the teaching of mathematics, science, and technology.					
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